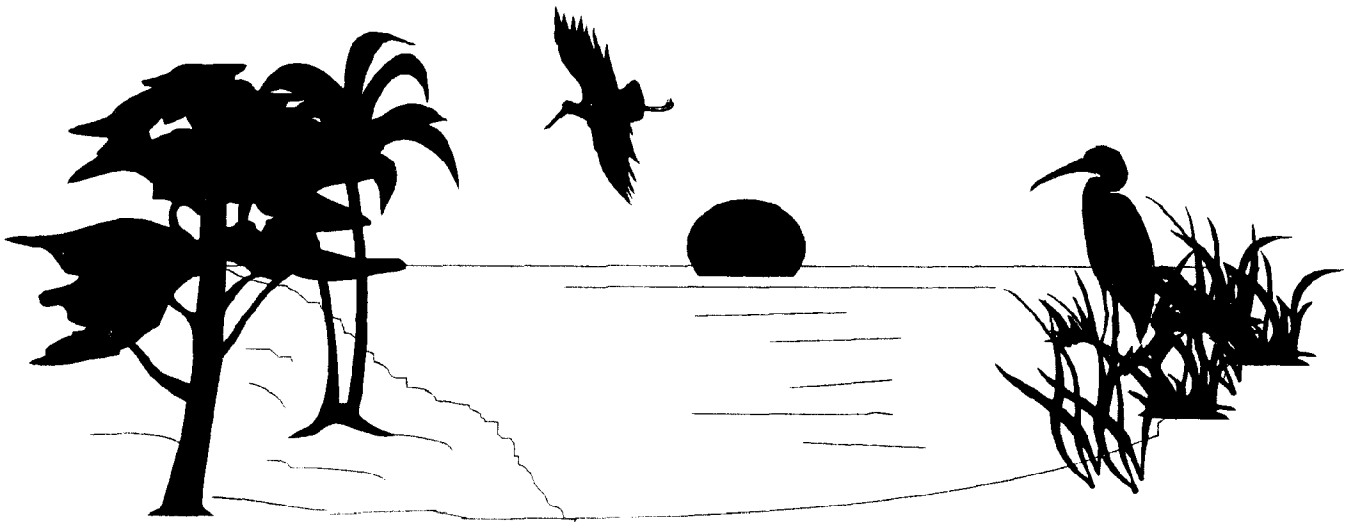
St. Marks and Wakulla Rivers Resource Assessment & Greenway Protection Plan

The Florida Greenways Program of
1000 Friends of Florida &
The Conservation Fund

Northwest Florida Water Management District

September 1994



TASK 3.1.07

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PREFACE

In 1991, 1000 Friends of Florida and The Conservation Fund teamed together to establish the Florida Greenways Program to aid in the conservation of greenways throughout Florida. The Florida Greenways Program is involved with greenway planning initiatives on the state and local levels. Since 1993, 1000 Friends of Florida has actively worked with the 38 member governor appointed Florida Greenways Commission. The mission of the Florida Greenways Commission is to establish a statewide system of linked open space (greenways), parks and refuges and recognize 150 greenways in celebration of Florida's sesquicentennial (150th) birthday in 1995.

On the local level, the Florida Greenways Program has initiated four regional prototype greenway planning projects. These greenway planning projects include: the Suncoast River Based Greenways Project in the Tampa area, the Loxahatchee Slough Greenways Project in Martin and Palm Beach counties, Broward County Urban River Greenways, the proposed South Walton Greenways effort in southern Walton County, and the Apalachee Greenways Project in Florida's Big Bend area.

Each of these projects focuses on the particular planning needs for each local area. The Suncoast greenways project focuses on the remaining green spaces along the Hillsborough, Alafia, Peace and Manatee Rivers. Hillsborough County has joined in the effort in establishing these rivers as greenways. The Loxahatchee Greenways effort is the first local project undertaken by the Florida Greenways Program and it focuses on the remaining greenway connections in a network connecting the natural areas of Jonathan Dickinson State Park, the Pal-Mar lands, the Dupuis Reserve, and the Corbett Wildlife Management Area. The Broward County Urban River Greenway effort focuses on designing and implementing a water-based greenways network in Broward County. This network will utilize the New River, the Intercoastal Waterway and the South Florida Water Management District's canal system to enhance community by providing open space and recreation. The decommissioned Cross Florida Barge Canal is being converted into the Cross Florida Greenway. 1000 Friends of Florida worked closely with the Canal Lands

Advisory Committee, the governors office and the legislature on the preparation of the greenway management plan.

In January 1993, the Florida Greenways Program, The Red Hills Conservation Association and the Apalachee Land Conservancy began working on a recreational, natural, cultural, and historic resource assessment of the Apalachee Region. Since that time, the Northwest Florida Water Management District and the region's local governments have joined in the assessment effort. The Apalachee Greenways Project focuses on a six county region of northern Florida (Gadsden, Jefferson, Leon and Wakulla counties) and southern Georgia (Thomas and Grady counties) stretching from the Aucilla River on the east to the Ochlockonee River on the west. The Apalachee Greenways Project highlights the significance of the region's historical canopy roads and plantations and the rivers providing their natural and cultural ties of the Red Hills to the river ports on the Gulf of Mexico. The Apalachee Greenways Project is being conducted in a series of three phases over a period of three years: Phase 1 - Regional Assessment and Visioning; Phase 2 - Network Planning and Demonstration Project; and Phase 3 - Resource Protection Implementation. The St. Marks and Wakulla Rivers Resource Assessment and Greenway Protection Plan is Phase 2 of the Apalachee Greenways Project.

The assessement and plan focuses on the St. Marks River watershed which includes the Wakulla River. The assessment addresses the watershed's cultural, historical, recreational and natural features. Like the broader Apalachee Greenways Project, the assessment and plan is centered on the rivers. The St. Marks and Wakulla Rivers link the communities of Jefferson, Leon and Wakulla counties. They have been used for thousands of years by various peoples settling in the Apalachee Region. They provide Apalachee Bay with nutrient rich water sustaining a healthy population of finfish and shellfish. The project emphasizes the need for greenway planning at the local, regional and state levels to maintain the existing water quality of the rivers.

Executive Summary

The Northwest Florida Water Management District, the Florida Greenways Program of 1000 Friends of Florida and the Conservation Fund, and the Florida Coastal Management Program have collaborated to develop a comprehensive resource assessment and greenway protection plan for the St. Marks and Wakulla rivers. This report assesses and maps the natural, recreational and historic resources in the St. Marks and Wakulla rivers watershed and offers recommendations for greenway conservation along the two rivers. This report is part of the Apalachee Greenways Project, a three-year effort funded by the Elizabeth Ordway Dunn Foundation and Waste Management Inc., Florida Group, to assess the region's greenway opportunities and identify potential conflicts with future growth. The St. Marks and Wakulla River Greenway assessment and plan is the second phase of the broader Apalachee project, and is funded in part by the Florida Coastal Management Program.

Greenways are a land and water conservation tool that can enhance open space and recreational opportunities, provide economic and community benefits, and intergovernmental cooperation. A greenway is a corridor of protected open space that is managed for conservation and/or recreation. They link natural reserves, parks, cultural and historic sites with each other, and in some cases with urban areas. Greenways can serve many ecological and recreational functions: as habitat for plants and animals; as conduits allowing movement; as barriers to noise, light and unsightly views; as sources of seed allowing natural succession in adjacent areas; as places to visit and explore; as conduits for people along trails; as biological filters trapping nutrients and pollutants; and as sinks capturing floodwaters.

This is the first study of the St. Marks and Wakulla rivers watershed to map and quantify at a detailed level the type, location, and extent of land uses and land cover. Satellite imagery data from 1993 was analyzed using the Northwest Florida Water Management District's Geographic Information System. Low-density residential uses comprise six percent of the total watershed with other urban types of land uses making up

less than one percent. Non-urban land uses comprise 93 percent of the watershed with silviculture uses (36 percent), natural upland forests (25 percent), and wetlands (18 percent) predominating.

Environmentally sensitive and important habitat lands were assessed to aid identification and mapping of greenway linkages (see Figure 1 - St. Marks and Wakulla Rivers Greenway). The Florida Game and Freshwater Fish Commission (FGFWFC) and the Florida Natural Areas Inventory provided data on land use and land cover, strategic habitat conservation areas, and rare animal, plant and communities occurrences. The FGFWFC data shows there are extensive areas of critical habitat throughout the watershed with the largest and highest quality habitat areas associated with the rivers.

Nonpoint source pollution (NPS) must be minimized if the quality of the St. Marks and Wakulla Rivers is to be protected. The assessment found that urban areas have the highest per-acre pollution rates while natural woodlands and silvicultural areas have the lowest per-acre pollution rates. On a watershed basis, forested and agricultural areas contribute the greatest NPS pollution load, but only because they have the greatest land coverage. These results suggest that NPS pollution can be expected to increase if silvicultural and forest lands are converted to more intensive land uses such as agriculture, residential or commercial. Implementation of best management practices (BMPs) for silviculture, agriculture and urban development are one important way to minimize NPS pollution. Best management practices are guidelines established by the Florida Department of Agriculture in conjunction with the forest/timber industry guiding forestry operations on proper tree harvesting, removal and replanting. Silviculture operations use the BMP's to determine where to harvest trees near rivers and streams and how much to harvest adjacent to streams.

The watershed's extensive public conservation lands provide many outstanding recreational opportunities. Annually, over one million visitors to the watershed fish, hunt,

Proposed St Marks and Wakulla Rivers Greenway

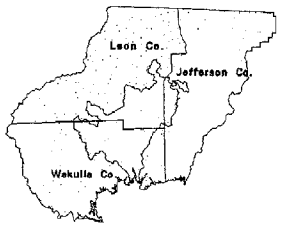

Figure 1

This publication was made possible by a subgrant from the Florida Department of Community Affairs, in Cooperation with the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, under Cooperative Agreement Award No. NA87OZ0427. Additional funding provided by the Elizabeth Ordway Dunn Foundation and Northwest Florida Water Management District.

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Florida Greenways

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Northwest Florida Water Management District
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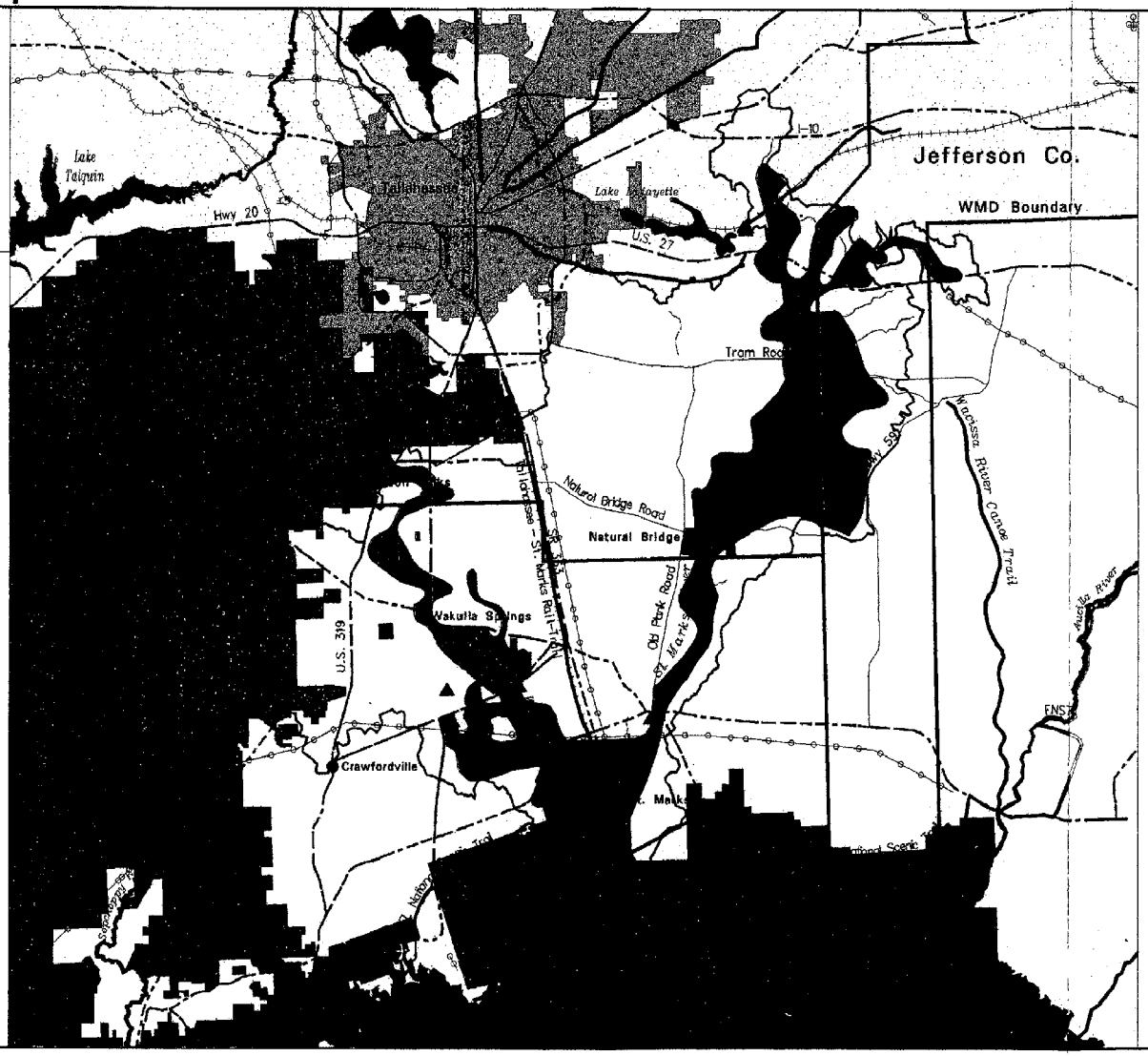

- City of Tallahassee
- Proposed Greenway
- Public Lands
- CARL Lands (Proposed)
- Watershed Boundary
- Major Roads
- Transmission Lines
- County & WMD Boundary
- Proposed Trails
- Existing Trails
- Canoe Trails
- Historic Features
- Natural Features
- Recreational Features

hike, swim, horse-back ride, off-road bicycle, in-line skate, canoe, kayak, and watch wildlife. They use trails such as the Florida National Scenic Trail, the Tallahassee-St. Marks Historic Railroad State Trail, the Big Bend Historic Saltwater Paddling Trail, and the canoe trails of the Wakulla and St. Marks rivers. Visitors enjoy outdoor recreational activities in the Apalachicola National Forest, St. Marks National Wildlife Refuge, and at Edward Ball Wakulla Springs State Park. They also learn about the areas rich historical and cultural past at Fort San Marcos de Apalache State Historic Site and Natural Bridge Battlefield State Historic Site. All of these combine to make watershed an outstanding ecotourism destination and while contributing to the regional economic base.

Because of the relatively undeveloped nature of the St. Marks and Wakulla rivers, the opportunity to conserve this natural greenway corridor still be exist. This greenway can help protect the water quality and fisheries of the rivers and Apalachee Bay, and help maintain their aesthetic and recreational appeal. These greenways are the watershed's linchpins for the ecosystem and the foundation on which to expand the area's economy through ecotourism.

The St. Marks and Wakulla Rivers Greenway is the unifying link between the watershed's conservation lands. Nearly all of the outdoor recreational activities within the basin are associated with the greenway in some manner. Wildlife thrives in the upper and lower reaches of the greenway. People recreate, live and work within and adjacent to it. and the greenway can help create a sense of place giving this unique area its own distinctive character.

The St. Marks and Wakulla Rivers Greenway will provide a rallying point or focus for conserving the natural, recreational and cultural resources which make the river corridors so attractive for people and wildlife. Living and owning property in the greenway does not impose additional restrictions on how lands are used. The existing comprehensive plan, development requirements and private and public stewardship will

continue to be the primary tools to conserve the qualities of the greenway. Residents and property owners within the greenway are recommended to voluntarily continue and strengthen their stewardship of their lands. The greenway will provide a focus for federal, state, regional and local agencies to work together with landowners, businesses and visitors to retain the watershed's qualities which are enjoyed by all. The resulting partnerships will help focus financial, administrative and stewardship resources so they are better coordinated and produce more effective results. The benefits of a coordinated greenway stewardship effort are much greater than the sum of the separate conservation and planning practices. Conserving the greenway is an excellent mechanism for ensuring sustainable development in the watershed.

There are many different tools that can and should be used the conserve the greenway. These range from private stewardship to community planning and public land acquisition. Citizens and public officials have the tools and are using them to conserve the important natural, recreational, and cultural resources of the greenway. Local governments should consider using the local comprehensive planning process to incorporate greenways into their communities. The provision of the plan revised to incorporate greenways could emphasize the economic and recreational benefits a community can realize if it works with other local governments as well as state and federal conservation efforts. Using the local planning process could help establish visibility and cohesiveness of the greenway concept while maintaining the necessary flexibility for each local government. The local governments should focus upon ways to improve intergovernmental cooperation and build public and private partnerships to conserve the greenway.

State and federal agencies also need to play a significant role in conserving the remaining large tracts of undeveloped land along both rivers. The majority of these lands are owned by a few owners and are managed principally for silviculture. Surface water protection could be improved through the development of a surface water improvement

and management program (SWIM) by the Northwest Florida Water Management District for the watershed. Lastly, the important role that citizens, users and landowners as stewards of the greenway is critical to this effort. Without their support and participation, this greenway conservation effort can not be successful.

In conclusion, the St. Marks and Wakulla rivers and their watershed offer an broad range of land and water conservation possibilities while providing eco-tourism economic development opportunities. The outstanding resources of the watershed and the Apalachee Region provide landowners, citizens and government with many opportunities to establish partnerships for land and water stewardship and enhance economic prosperity. Conserving the St. Marks and Wakulla River Greenway will help the watershed's communities take advantage of these opportunities.

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CHAPTER 1

OVERVIEW

CHAPTER I - OVERVIEW

In late 1993 the Northwest Florida Water Management District, 1000 Friends of Florida, and the Florida Coastal Management Program teamed up to complete a comprehensive resource assessment and greenway protection plan for the St. Marks and Wakulla rivers. The watershed of these two rivers is the next project listed on Northwest Florida Water Management District's Surface Water Improvement and Management Plan (SWIM) priority list. The Florida Greenways Program of 1000 Friends of Florida and the Conservation Fund is conducting a three year study of the Apalachee region and joined the District in emphasizing the significance of the St. Marks watershed in terms of the diverse productive natural resources, scenic recreational resources, and the historical and cultural assets. The drainage basins of the St. Marks River and its largest tributary, the Wakulla River, comprise the St. Marks Watershed (see Figure 2 - Project Boundary Map).

Because of the relatively undeveloped nature along these rivers, there is an opportunity to take a proactive approach to develop effective long term conservation strategies for these two rivers. Unlike many south and central Florida rivers which are already largely developed or degraded by development, the St. Marks and Wakulla rivers currently have relatively good water quality which supports healthy fresh and saltwater ecosystems, including an important commercial and recreational fisheries (Hand and Paulic 1992 b).

The opportunity exists for interested citizens and local, regional and state officials to strengthen river stewardship efforts by conserving natural greenway

St Marks and Wakulla Rivers Watershed Study Area

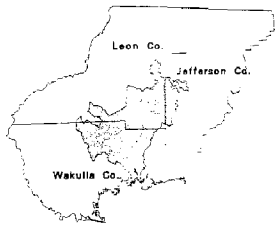

Figure 2

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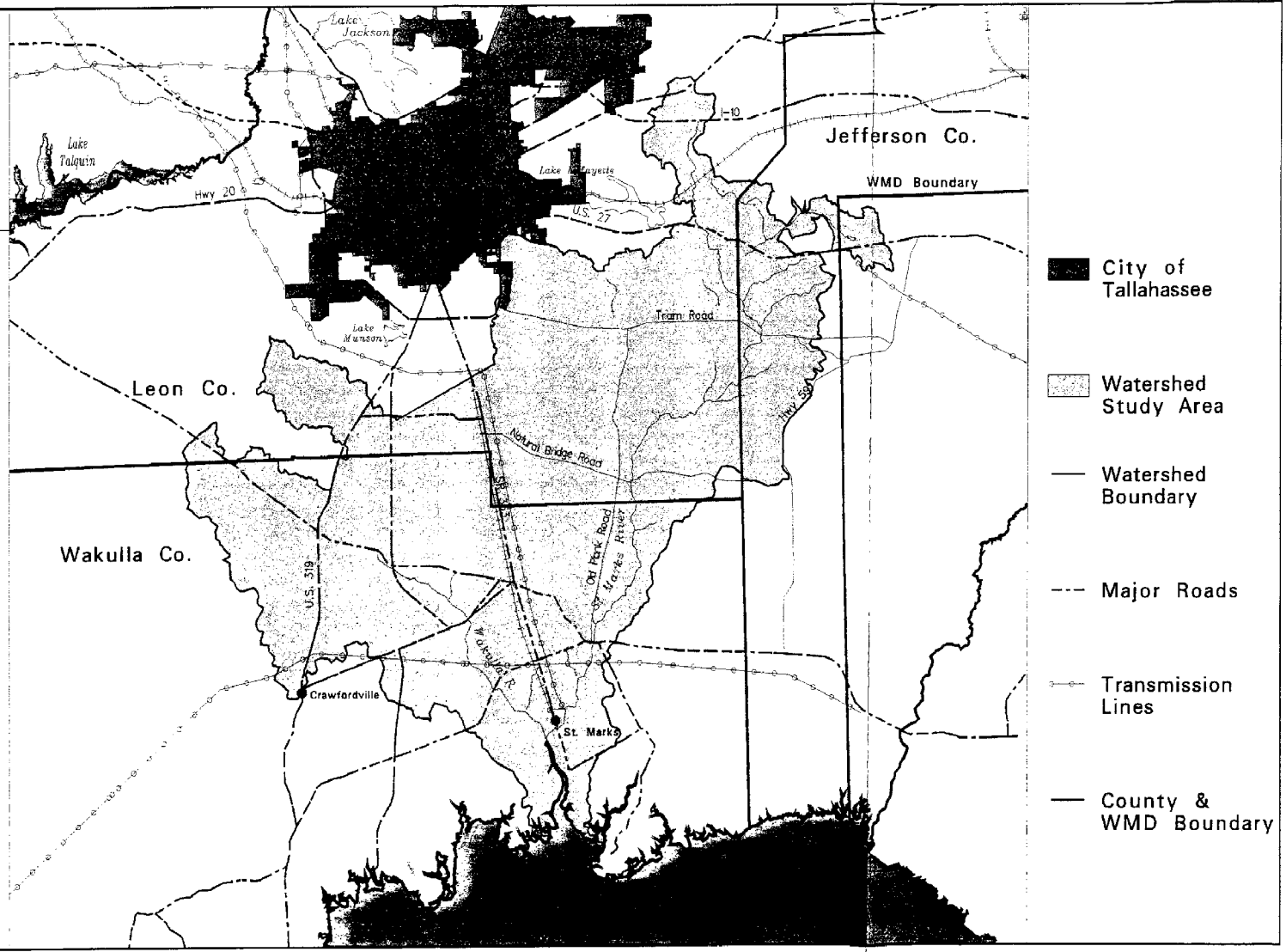


corridors along the St. Marks and Wakulla rivers. Because it is cheaper and easier to prevent water quality degradation than it is to clean it up, efforts should be initiated now to conserve the existing greenways along these rivers.

The St. Marks and Wakulla rivers have many other positive attributes besides good water quality. The river and their associated swamp forest, sloughs, and marshes, support an abundance of wildlife. The port Town of St. Marks is dependent upon the St. Marks River channel to support shipping as well as commercial and recreational fishing activities. The natural beauty and clean waters of this area draw many people to live, work and enjoy the watershed's diverse recreational opportunities. Conserving the natural greenway corridor along the rivers will help maintain their aesthetic and recreation appeal while preserving the ecological function of the riverine forest system.

This river system provides habitat for hundreds of different species of plants and animals who share the river and its banks with people and their homes. The ecological aspects of the rivers should be managed in perpetuity because a healthy functioning ecosystem not only benefits the plants and animals, but it also benefits people.

There have been no comprehensive studies made on the St. Marks and Wakulla rivers, but fortunately these rivers have characteristics similar to other more extensively studied Florida river systems. This report assesses the natural, recreational and historic resources within the St. Marks and Wakulla River Watershed and offers recommendations for conserving the greenway along the two river systems, including:

- a description of the greenway concept and the benefits greenways can provide the region' communities;
- documentation of existing watershed land uses and land cover through analysis of satellite imagery using the District's Geographic Information System (GIS);
- an analysis of nonpoint source pollution;
- an assessment of the natural, recreational and historical resources of the watershed;
- greenway opportunities in the watershed;
- a review of local government comprehensive plans;
- a review of state programs that could assist with greenway conservation;
- recommendations for the development of the St. Marks and Wakulla River Greenways and;
- citizen concerns regarding greenway planning.

GREENWAYS - DEFINED

Greenways are a land and water conservation tool that can enhance open space, and recreational opportunities, provide economic and community benefits, and improve intergovernmental coordination. Figure 3 provides the definition of a greenway adopted by the Florida Greenways Commission. Greenways can be classified on a continuum from ecological to conservation to recreational greenways. Ecological greenways are designed and maintained primarily for wildlife habitat protection. Typically, development is limited in the ecological greenway because these greenways are often located in pristine natural areas where there is little human encroachment or urbanization.

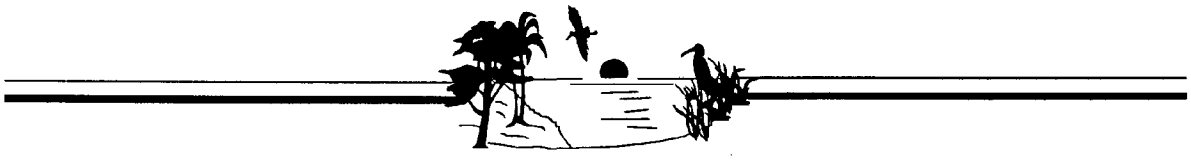
What is a Greenway?

A greenway is a corridor of protected open space that is managed for conservation and/or recreation. The common characteristic of greenways is that they all go somewhere. Greenways often follow natural land or water features, like ridges or rivers. They link natural reserves, parks, cultural and historic sites with each other, and in some cases with urban areas. Greenways not only protect environmentally sensitive lands and wildlife habitat, but they also provide people with outdoor recreation opportunities ❖

Florida Greenways Program 1992a.

Figure 3

Conservation greenways provide both natural resource protection and recreation benefits. A conservation greenway is a linear landscape feature that facilitates biologically effective transport of both animals and plants between larger patches of habitat dedicated to conservation (Soule 1991). Soule points out that corridors / greenways are transitional habitat and that they only need to provide the necessary resources for plant or animal movement from one area to another (Soule 1991). However, if the greenway corridor is large enough it can also provide for wildlife



habitat. Trails and other passive recreation opportunities can be developed within a conservation greenway (Florida Greenways Program 1992 a).

Recreational greenways are primarily managed for public access and enjoyment through trails. Trails are marked routes that provide access to and appreciation of the values of natural areas and greenspaces, present diverse resource based outdoor recreational opportunities, and enhance the understanding of historical sites and cultural diversity.

Ecological and Recreational Functions of Greenways

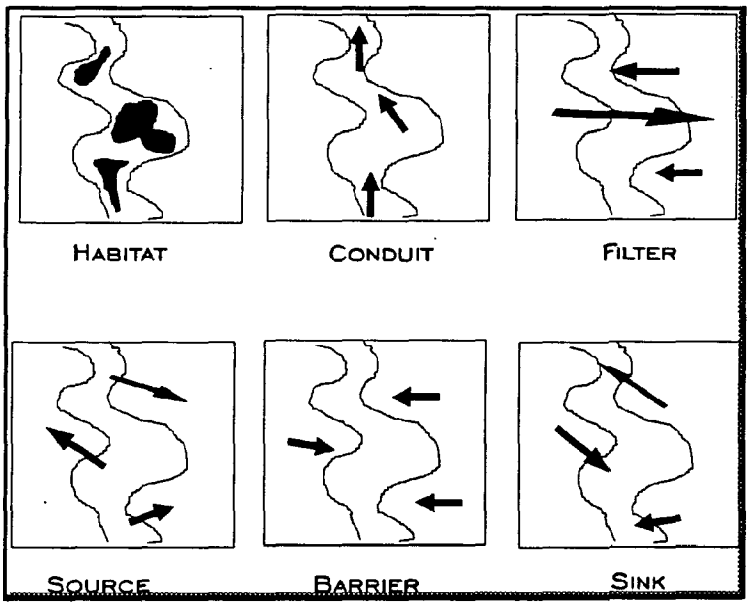


Figure 4, Labaree 1992.

The landscape in the watershed is a series of interactions between plants, animals, the soil and water. A healthy environment depends on maintaining these interactions (Labaree 1992). When planning for future growth the interactions and natural connections of landscape need to be considered. Greenways can provide landscape linkages to recreational trails. There are the six ways greenways can function as ecological and recreational units and these concepts are based on landscape ecology principals.

HABITAT

Greenways can function as wildlife habitat, but this will depend on the size of the greenway. The nature of the surrounding land also effects the function of habitat suitability. Generally, the larger a greenway, the more species it will support, because many interior species will not tolerate competition from edge species. Edge species are those plants and animals that are found in open or developed land. They can live almost anywhere and feed on a wide variety of foods. Interior forest species often have very specific diets and habitat requirements. The Pinhook Swamp connecting the Okefenokee National Wildlife Refuge in Georgia to the Osceola National Forest in Florida is an excellent example of how greenways offer habitat protection and preservation. The Pinhook Greenway functions as a protected large landscape linkage between the larger core habitat areas of the swamp and national forest providing habitat for large predators such as the Florida Panther and the Florida Black Bear.

CONDUITS

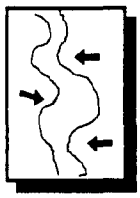
The typical conservation greenway is a linear feature providing for animal and plant dispersion across the landscape. These greenways function as wildlife conduits by providing safe protected passages between conservation areas. By increasing the effective size of the habitat and providing wildlife access to varied areas, conduit greenways provide a mechanism countering the effects of habitat fragmentation caused by urbanization. By increasing the effective size of the habitat,

conduit greenways can help species meet their home range needs by linking parks and conservation areas with a network of protected open space. The greenway itself may not actually be large enough to serve as habitat. However, if the greenway links to other larger parcels of land, then the linkage itself increases the effective habitat by reconnecting the land.

River corridors and ridgelines are typical examples of conduit greenways. The linear dendritic pattern of riparian forests makes them ideal collectors and transporters of wildlife across the regional landscape. Ideally, riparian greenways would be designed to be wide enough to encompass a broad range of habitat types for aiding plant and animal movement (Noss and Harris 1989).

Greenways can also function as recreational conduits by providing an interconnected network of trails or scenic highways for the purposes of linking people with points of interest, scenic vistas, natural, cultural and historic resources or for providing wilderness solitude and personal challenges. The Appalachian Trail is an excellent example of a greenway functioning as a recreational conduit. The Tallahassee-St. Marks Historic Railroad State Trail, the Blue Ridge Parkway, canopy roads, and urban river/bay walks are additional examples of how greenways function as recreational conduits. Greenways also provide opportunities for alternative transportation through multi-purpose trails. Trails are different from greenways in that they do not exist alone, but instead traverse greenways, parks and other open space areas. Trails are defined as linear corridors, on land or water, with protected status and public access for recreation or transportation (National Park Service 1990). Trails link people with the natural and cultural environment.

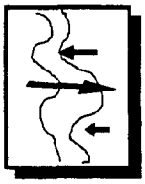
Barriers



Greenway vegetation can function as barriers to unsightly views and noise if large enough in size. By protecting scenic vistas and landscapes, greenways can provide a sense of place or character for a particular area such as the canopy roads and historic plantations in north Florida and south Georgia's Red Hills Region. Conservation easements along scenic roads and improved urban river fronts such as San Antonio's River Walk, could function as barrier greenways.

Filters

Greenways can function as natural filters. Riverine greenways are receivers of nutrients from uplands and feeder streams. Riverine greenways can filter out nutrients, sediments, and other pollutants from stormwater runoff. This is dependent on the greenway's size and the type and quality of vegetation of the riparian greenway. Woody plants will remove more nitrogen and phosphorous from nutrient rich run-off than non-woody species.

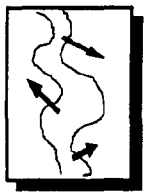


Sinks

Riparian greenways can act as nutrient sinks through the moderation of water flow in the associated river and the absorption of water and associated nutrients into the groundwater. These phenomena are especially evident during natural periodic floods that the river/stream experiences. Recreation based greenways can function as sinks by focusing use to an area designed to accommodate that use and minimize impacts on the areas requiring special protection.

Sources

Finally, greenways can function as biological sources. They can be sources of native seeds for wetland and upland species. If the surrounding land use patterns are urban or agricultural in nature, then the greenways function as linear seed banks. This becomes especially evident if the adjacent land is left fallow and undeveloped. Ecological succession would occur and the greenway could be the seed source for succession. Greenways can also provide protected water sources for wildlife and plants if they are located along rivers or streams.



Depending on the design and for whom or what the greenway is intended, a greenway could provide all six functions within the greenway or it may just serve one or two functions. All ecological greenway functions can occur only if the greenway is large or long enough and is connected to important habitat areas. Spatial scale is an important factor in considering greenway function. Scale or size determines what plants and animals

can utilize the greenway and how well the greenway functions as a filter. If the greenway is too small it will not be of much use to large mammals or as a river or lakeside water filter.

Benefits of Greenways

No other conservation initiative effectively provides as many benefits or serves so many different purposes as greenways. Greenways not only help protect environmentally

Benefits Provided by Greenways

- **Decrease habitat fragmentation by connecting core habitat areas,**
- **Provide plant and animal habitat,**
- **Aid in reducing the effects of flooding by maintaining the natural floodway where water can naturally accumulate,**
- **Maintain and improve river water quality through the natural filtration of nutrients and sediments,**
- **Enhance recreation opportunities for land or water- based activities,**
- **Provide for historic interpretation,**
- **Offers a great business marketing tool for communities searching for ecotourism - related businesses,**
- **Increase property values of homes and business located adjacent to the greenway,**
- **Provide a measuring stick and marketing philosophy used by many communities to help determine the quality of life of their community, and**
- **Provide people a quiet place from which to draw inner strength**

Figure 5 Sources: Greenways, Inc. and the Florida Greenways Program

sensitive lands and wildlife habitat, but they also provide people with outdoor recreation opportunities. These benefits are highlighted in Figure 5.

Greenways and Water Quality Protection

Greenways provide water quality protection by conserving floodplains which provide water storage and conveyance during high water periods as well as filtering functions for stormwater runoff. The ecological integrity of a stream or river is largely affected by its response to sediment, nutrients, and other materials originating from the surrounding uplands (Binford and Buchenau 1993).

Greenways also reduce the impacts of non-point pollution and reduce the impacts of flooding on property and human lives, while also providing for wildlife habitat.

Greenway Benefits to Water Quality

- **Hydrologic Regulation of Stream Flow - Flood Management**
- **Sediment and Nutrient Filtration / Control**
- **Nutrient Removal**
- **Water Temperature Regulation**

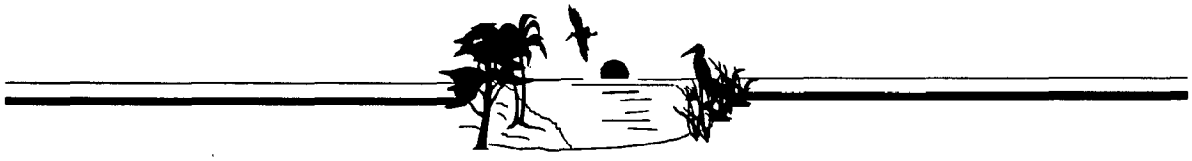
Greenways help regulate water temperatures through shading by overhanging trees along the waterbody (Binford and Buchenau 1993) . This becomes more important in headwater areas where the streams can be almost entirely covered by the natural canopy of the forest. Many species of freshwater fish can not tolerate high water temperatures, because warmer waters carry less oxygen.

Greenways and Quality of Life

Greenways can improve the quality of life of the communities which they connect and pass through. One of the most important intangible benefits is conserving scenic areas, thus helping a community retain its distinctive character. Greenways are a tool to develop a sense of community by providing linkages to neighborhoods and parks. Greenways provide a meeting place for cultural exchange where citizens can talk to one another about events of the day. Greenways are now being incorporated into neotraditional neighborhood designs linking communities and parts of communities through a series of open spaces and parks. Greenways have the potential to get people out of their homes and cars and into the openness of their neighborhoods and communities where they can meet their neighbors.

There are also several tangible benefits of greenways. Studies have shown that real property values have increased 5 to 20 percent in residential areas located next to or within the greenway. The National Home Builders Association reported a 10 to 20 percent increase in value of residential property in the vicinity of park facilities (Greenways, Inc 1994). In Raleigh, North Carolina people selling their homes near greenways, often use the amenity value of the greenway as a marketing and sales tool (Greenways, Inc 1994).

Greenways in these cases can also aid property owners through whose lands they pass by making them eligible for reductions in real estate taxes, income and estate taxes. Usually, the owner would retain the ownership of the land, but would agree to limit development in the greenway through a conservation easement. Other options include purchasing the land in fee simple or leasing the land for a number of years (Greenways, Inc 1994).



CHAPTER 2

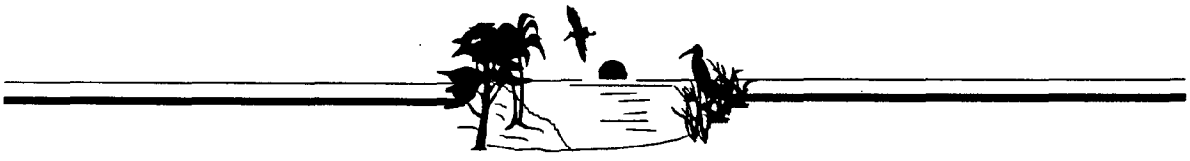
RESOURCE ASSESSMENT OF THE ST. MARKS & WAKULLA RIVER WATERSHED

Chapter 2 - Resource Assessment of the St. Marks and Wakulla Rivers Watershed

Overview

The St. Marks and Wakulla Rivers Greenway Project is located in the Apalachee region of Florida's Big Bend and is a part of the larger Apalachee Greenways Project. The name of the Apalachee Region is borrowed from the Apalachee Bay which forms the Gulf of Mexico's coast of along Wakulla County and portions of Franklin and Taylor counties. Due to the Apalachee Bay's shallow waters, its remoteness and the protected lands and waters of the St. Marks National Wildlife Refuge, the Apalachee Region has one of Florida's most undeveloped coastlines. The Apalachee Region is also famous for its seafood, majestic live oaks, Florida's capital of Tallahassee with its universities, and its abundant natural, cultural and recreational resources which span from Thomasville, Georgia to the Gulf of Mexico.

The Apalachee region is home to a vast array of natural resource areas such as the St. Marks National Wildlife Refuge, Florida's largest national forest - the Apalachicola National Forest, extensive native stands of long leaf pine in the Red Hills Region of southern Georgia and northern Florida, and several Florida state parks, forests, recreation and historic sites. The Red Hills Region combined with the Apalachicola National Forest comprises Florida's largest nesting area for the threatened Red-cockaded Woodpecker. Over 600 colonies of Red-cockaded Woodpeckers occur within the National Forest having. The Apalachee region also provides excellent habitat for one of Florida's largest populations of Florida Black Bear.



Outstanding recreational opportunities abound in and associated with the region's many natural resource areas. The Apalachicola National Forest has over 100 miles of hiking and equestrian trails and 15 developed recreation areas. Approximately 100 miles of the Florida National Scenic Trail traverses the southern part of the region passing through the St. Marks National Wildlife Refuge and the Apalachicola National Forest. The 16 mile long Tallahassee - St. Marks Historic Railroad State Trail travels from Tallahassee to the riverside Town of St. Marks near the Gulf of Mexico where it intersects the Florida National Scenic Trail. The proposed GF&A Rail Trail will run 53 miles from Tallahassee to Carrabelle passing through historical communities like Sopchoppy and Arran. The Apalachee region is renowned for its hunting and boating opportunities. The coastal marshes and beaches provide opportunities for sea kayaking, windsurfing and saltwater fishing. The St. Marks National Wildlife Refuge is an excellent place for bird watching.

Many historical places of interest are scattered throughout the region. The Red Hills area retains many historic plantations and buildings and a more traditional southern lifestyle. The communities of Quincy, Monitcello, Capps, Tallahassee, Thomasville, and Waukeenah have designated historic districts with many restored buildings on the National Historic Register. The canopy roads follow historic trade routes of 1800's and are some of the region's most distinctive features. The legacy of Spanish explorers and missionaries is interpreted through the Fort San Marcos de Apalache in St. Marks and the San Luis Mission in Tallahassee.

The threads that tie the Apalachee region together are the six rivers which drain the region - the Ochlockonee, Sopchoppy, Wakulla, St. Marks, Wacissa, and Aucilla rivers. These nutrient-rich rivers feed Apalachee Bays' productive fishery. These rivers have

good water quality, little development along their banks, and offer excellent canoeing and fishing opportunities for the outdoor enthusiast. Spring fed rivers such as the Wacissa and Wakulla Rivers affords the opportunity to paddle along crystal clear waters, while the Ochlockonee, Sopchoppy, St. Marks and Aucilla Rivers are outstanding examples of tannin-stained blackwater rivers. The Woodville Karst Plain which is pocketed with sink holes and springs is in the southern portion of the Apalachee region. Wakulla Springs at Edward Ball Wakulla Springs State Park is one the world's largest first magnitude springs. The Leon Sinks Recreation Area in the Apalachicola National Forest provides visitors the opportunity to view many magnolia-lined sinks scattered through sand hills and pine forest. The rivers and springs are fed by the Floridan Aquifer which is replenished by an annual average rainfall of 60 inches.

The St. Marks Watershed, including the Wakulla River sub-basin, was chosen for greenway study and analysis by the Florida Greenways Program and the Northwest Florida Water Management District (NWFWMD) for several reasons. First, the District is investigating the feasibility of initiating a Surface Water Improvement and Management Program (SWIM) for the St. Marks watershed as its next SWIM project for the District. Secondly, the St. Marks and Wakulla rivers retain many of their outstanding natural characteristics which warrant conservation. These rivers have good water quality supporting a wide variety of freshwater and estuarine plants and animals. The entire riverine and estuarine system could be degraded without proper land use stewardship and growth management. The St. Marks and Wakulla Rivers Greenway Project also represents an area specific demonstration project for the larger Apalachee Greenways effort. The goal of the project is to identify ways to conserve the river corridors and in the ecological, hydrological and economic functions which benefit the entire Apalachee

Region.

This project is intended to provide the framework for future greenway planning for the watershed. This project stresses a watershed approach to greenway and surface water protection because wildlife and nonpoint source water pollution do not recognize political boundaries. Many local, regional, state and private interests have been brought together to approach the greenway planning and mapping task as a regional effort. The following sections describe the resource assessment and mapping components of the project.

The project boundaries were selected through the analysis of United States Geological Survey (USGS) 1:24,000 quadrangle maps and other information from the Northwest Florida Water Management District. The project's watershed boundaries do not include the drainage basins of Lake Munson, Lake Lafayette or Lake Miccosukee. Since this project is a Coastal Zone Management Project, its concern is on direct surface water hydrologic boundaries and connections (see Figure 2 - Project Boundary). While these lakes do not have a direct surface water connection to either the St. Marks or the Wakulla rivers, these lakes do influence the water quality and quantity of the rivers through a groundwater interconnection. Analysis of these connections are beyond the scope of this study, both in terms of time and funding. Future analyses of the watershed should explore the relationships and connections between these lakes, the groundwater of the Floridan aquifer and the St. Marks and Wakulla rivers. The qualities of the St. Marks and Wakulla rivers can not be maintained without addressing the protection of both the interconnected surface and groundwater system.

A focus of this project is identifying and mapping land uses, significant natural, cultural and recreational resources in the watershed, and a nonpoint source pollution assessment. Computerized digital resource data identifying important habitat areas and public lands were provided by the Florida Natural Areas Inventory and the Florida Game and Fresh Water Fish Commission. Cultural and recreational data were collected by the Florida Greenway Program from various sources including the Florida Trail Association, the USDA Forest Service, the USDI Fish and Wildlife Service, the Florida Department of Environmental Protection, the Florida Department of State, and local historians. Much of this data was gathered at an Apalachee Greenways mapping charrette held on May 21,1993 in Tallahassee. Resource experts were invited to the charrette to map cultural, historical, recreational and natural resources on 1:100,000 quadrangle USGS maps. The non-computerized resource data collected for the project were mapped on 1:24,000 quadrangle USGS maps and then digitized into to the NWFWMD Geographic Information System (GIS).

The criteria used in selecting the resources identified for the St. Marks Greenways Project includes the following:

- Significant habitat for listed species,
- Existing and proposed Conservation and Recreation Lands (CARL) lands
- Significant natural features,
- Significant cultural and historic sites (sensitive cultural and historical features on private lands were not mapped).

- State parks, recreation areas, and historic sites where the public is invited to visit,
- Public recreational trails including the Florida National Scenic Trail, the Tallahassee - St. Marks Historic Rail Trail and the Wakulla River State Canoe Trail,
- Unique geologic features of the region, such as sink holes and springs,
- National Forest lands and recreation areas, and
- Historic canopy roads open to the public.

Land Use Assessment

The purpose of the land use assessment was the identification and mapping of existing land use and land cover for the St. Marks and Wakulla Rivers watershed. The St. Marks and Wakulla Rivers watershed (see Figure 2 -Project Boundary Map) includes approximately 200,000 acres or about 310 square miles and includes portions of Wakulla, Leon and Jefferson counties. This was the first time that the type, location, and amounts of land use and land cover have been mapped and quantified at this level of detail for this watershed. Land use data were also used as the basis for the nonpoint source assessment. While this assessment has provided more detailed information than any previous studies, it should be noted that this information is intended for use at the regional level. Specific land cover for a particular site should be verified through site inspection.

Satellite image GIS analysis of 1993 data was used to map existing land use and land cover throughout the watershed. These maps provided an overview of existing land uses and vegetation within the watershed (Appendix I). Existing land use and land cover were categorized using a state-wide classification system developed by the Florida Department of Transportation (FDOT) for consistency within Florida. (FDOT, 1985. See also Appendix II).

The FDOT land use categories were chosen rather than the local comprehensive plan land use designations for two reasons. First, FDOT system includes land cover categories, such as upland forest, which are not addressed by the local comprehensive plans. Second, the statewide system provides a way to consistently categorize land use

within the watershed while the local land use categories differ between each city and county. For example, low density residential in one county may be one dwelling per five acres and in another county, low density residential may include up to two dwellings per acre. Therefore, the land use designations used in this assessment may differ from those used in the local comprehensive plan existing and future land use maps.

Land use and land cover were identified based on what could be "seen" by the satellite. Ownership information was not included in the land use assessment. For example, a tract of land which is considered to be silviculture by the owner might include areas mapped as silviculture, brush lands, upland forest, or wetlands based on the visible land cover. It should also be noted that the areas identified as wetlands in this assessment may not be jurisdictional wetlands. Although the FDOT categorizes land cover as either uplands or wetlands, many of the "upland" forests classes were found in low, wet areas and contained approximately equal portions of upland and wetland vegetation. More than 40 categories of land use and land cover were mapped. For the purposes of this report, the land use and land cover data has been aggregated into 15 categories. More detailed land use information is available on request from the NWFWMD

Land use and land cover were checked through ground truthing on site or by air photos. Sites were selected for ground truthing based on accessibility. Much of the land within the watershed is either private property or not accessible by road.

RESULTS

Land use and land cover within the watershed are shown in Figure 6 - St. Marks and Wakulla Rivers Watershed Existing Land Use and Land Cover. For discussion purposes all percentages have been rounded. The land use and land cover categories are consistent with the FDOT system.

Urban. Urban land use comprises 13,439 acres (7 percent) of the St. Marks and Wakulla Rivers watershed. This contrasts sharply with 185,274 (93 percent) acres of non-urban land use within the entire watershed (see Table 1, Land Use Acreage and Percentage). Low density residential represented the largest number of urban acres and made up 6 percent of the total watershed (12,240 acres). However, the majority of the residential lands could not truly be characterized as "urban". With the exception of the towns of St. Marks, and Crawfordville and the Woodville community, the average residential density within the watershed is approximately one dwelling unit per three acres. There were no FDOT medium (2 to 5 units per acre) or high density (greater than 5 units per acre) residential uses identified within the watershed.

Remaining urban categories individually made up less than 1percent of the acreage in the watershed. These categories included commercial (499 acres), industrial (454 acres), and institutional (81 acres). Open urban land (111 acres) includes areas which have been cleared and have infrastructure but have not yet been developed. Recreational use (56 acres), includes the developed portions of Wakulla Springs. The undeveloped portions of the state park were classified by land cover type.

TABLE 1. LANDUSE ACREAGE AND PERCENTAGE

LANDUSE CATEGORY	ACRES	PERCENTAGE
Urban Land Uses in the Watershed		
Residential	12,239.60	6.16%
Commercial	498.90	0.25%
Industrial	453.70	0.23%
Institutional	81.00	0.04%
Recreation	55.60	0.03%
Open Urban Land	110.60	0.06%
Nonurban Land Uses and Land Cover in the Watershed		
Agriculture	20,075.40	10.10%
Shrub and Brushland	7,340.40	3.69%
Upland Forest	49,083.30	24.70%
Silviculture	71,049.60	35.75%
Lakes/Waterways	1,380.30	0.69%
Wetlands	36,033.00	18.13%
Beaches	20.20	0.01%
Spoil/Barren	166.40	0.08%
Transport./Utilities	125.00	0.06%
Urban Subtotal	**13,439.30**	6.76%
Nonurban Subtotal	**185,273.50**	93.24%
Total Acres	**198,712.90**	100.00%

Non-urban. Non-urban land use accounted for 93 percent (185,274 acres) of the acreage in the St. Marks and Wakulla Rivers watershed (Table 1 - Land Use Acreage and Percentage). The greatest percentage of non-urban acreage in the watershed was silviculture (36 percent or 71,050 acres). Natural upland forests included 49,083 acres (25 percent). Approximately one third of the natural upland forests are comprised of xeric (scrub) oak. Much of the upland forest lands are either located in the Apalachicola National Forest are owned by the forestry industry. Agriculture, which includes both cropland and pastures, comprising 20,075 acres (10 percent) within the watershed. Transportation and utilities which comprising 125 acres (less than 1 percent) of the total watershed acreage. Lakes and waterways comprise 1,380 acres (less than 1 percent) of total watershed acreage, which are primarily the two rivers and their tributaries.

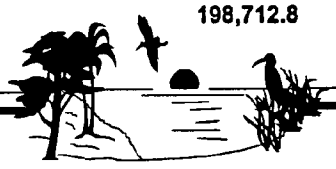
Wetlands comprise 36,003 acres (18 percent) of the watershed. Spoil/barren lands (166 acres) and beaches (20 acres) comprised less than 1 percent of the total acreage in the watershed and are located primarily within the coastal portion of the study area.

County Comparisons

The relative distribution of urban and non-urban land use and land cover for each county is presented in Table 2 - Urban and Non-Urban Land Use and Land Cover Acreage and Percentage by County. The majority of acreage within the St. Marks and Wakulla Rivers watershed is located within Wakulla County (48 percent). Leon County comprises 41 percent and Jefferson County comprises 10 percent of the total watershed acreage.

Table 2. Urban and Non-urban Land Use and Land Cover Acreage and Percentage by County for the St. Marks Watershed

Jefferson County	Acreage	Percent
Agriculture	4,743.3	2.39%
Shrub and Brushland	2.2	0.00%
Natural Upland Forests	3,835.1	1.93%
Silviculture	5,822.9	2.93%
Waterways and Lakes	72.0	0.04%
Wetlands	6,242.2	3.14%
Transportation/Utilities	4.4	0.00%
Urban Subtotal	**0.0**	**0.00%**
Nonurban Subtotal	**20,722.0**	**10.43%**
County Subtotal	**20,722.0**	**10.43%**
Leon County		
Agriculture	9,679.6	4.87%
Shrub and Brushland	3,695.3	1.86%
Natural Upland Forests	13,187.5	6.64%
Silviculture	33,435.1	16.83%
Waterways and Lakes	277.1	0.14%
Wetlands	16,307.6	8.21%
Spoil and Barren Lands	109.0	0.05%
Transportation/Utilities	92.8	0.05%
Urban Subtotal	**5,573.8**	**2.80%**
Nonurban Subtotal	**76,783.9**	**38.64%**
County Subtotal	**82,357.7**	**41.45%**
Wakulla County		
Agriculture	5,652.5	2.84%
Shrub and Brushland	3,642.9	1.83%
Natural Upland Forests	32,060.7	16.13%
Silviculture	31,791.6	16.00%
Waterways and Lakes	1,031.2	0.52%
Wetlands	13,483.1	6.79%
Beaches	20.2	0.01%
Spoil and Barren Lands	57.5	0.03%
Transportation/Utilities	27.8	0.01%
Urban Subtotal	**7,865.5**	**3.96%**
Nonurban Subtotal	**87,767.6**	**44.17%**
County Subtoal	**95,633.1**	**48.13%**
TOTAL	**198,712.8**	**100.00%**



St Marks and Wakulla Rivers Watershed Existing Land Use and Land Cover

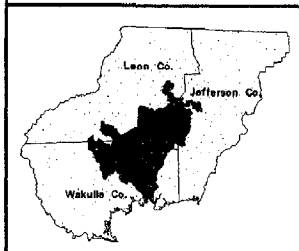


Figure 6

This publication was made possible by a subgrant from the Florida Department of Community Affairs, in cooperation with the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, under Cooperative Agreement Award No. NA87OZ0427. Additional funding provided by the Elizabeth Ordway Dunn Foundation and Northwest Florida Water Management District.

September 1994

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Florida Greenways

FRIENDS 1000 FLORIDA

Northwest Florida Water Management District
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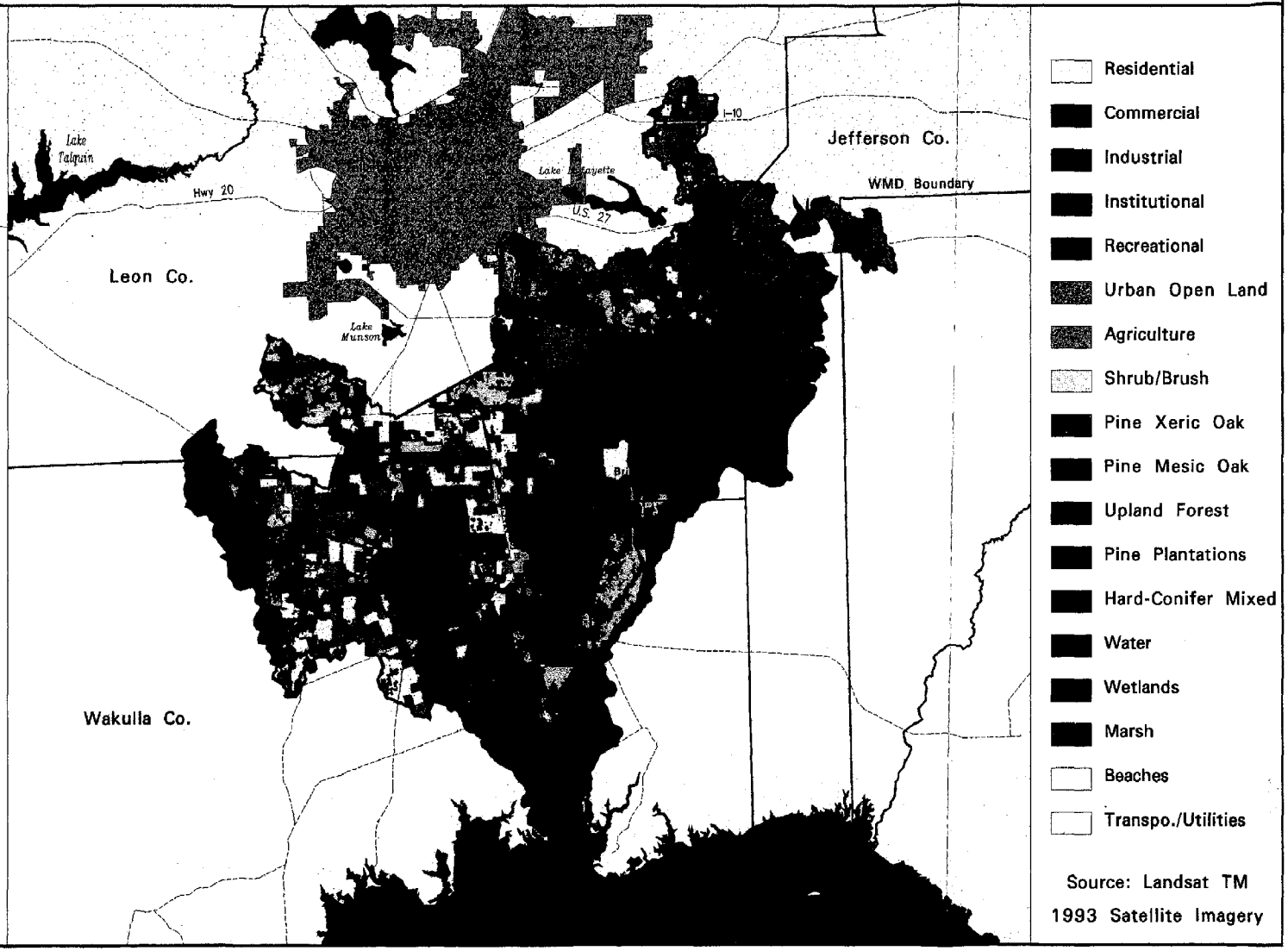


- Residential
- Commercial
- Industrial
- Institutional
- Recreational
- Urban Open Land
- Agriculture
- Shrub/Brush
- Pine Xeric Oak
- Pine Mesic Oak
- Upland Forest
- Pine Plantations
- Hard-Conifer Mixed
- Water
- Wetlands
- Marsh
- Beaches
- Transpo./Utilities

Source: Landsat TM 1993 Satellite Imagery

No urban land uses were identified within the Jefferson County portion of the watershed. The predominate non-urban land cover type within Jefferson County was wetlands, followed by silviculture, agriculture and natural upland forests. Leon County included more than 5,500 and Wakulla County, more than 7,800 acres of urban land use. The majority of these urban uses are very low density residential development. Leon County non-urban acreage includes silviculture (33,435 acres), wetlands (16,308 acres), natural upland forest (13,188 acres) and agriculture (9,680 acres).

Due to the presence of the Apalachicola National Forest and the St. Marks National Wildlife Refuge, the majority of non-urban land cover within Wakulla County is natural upland forests (32,061 acres). Silviculture (31,792 acres) includes almost as much area as upland forests. Wetlands comprise 13,483 acres within the Wakulla County portion of the watershed. These wetlands include coastal salt marsh as well as riverine wetlands (see Figure 6 - Existing Land Use and Land Cover).

Nonpoint Source Pollution Assessment

This section of the report presents an evaluation of existing nonpoint source (NPS) pollution contributions from land use within the St. Marks and Wakulla Rivers watershed. Increases in the nonpoint loading of this system could have serious effects on water quality. Nonpoint pollution sources include agriculture and silviculture activities present throughout the watershed and, runoff from various dirt roads intersecting tributaries. Additional nonpoint sources of pollution in the watershed include stormwater runoff, septic

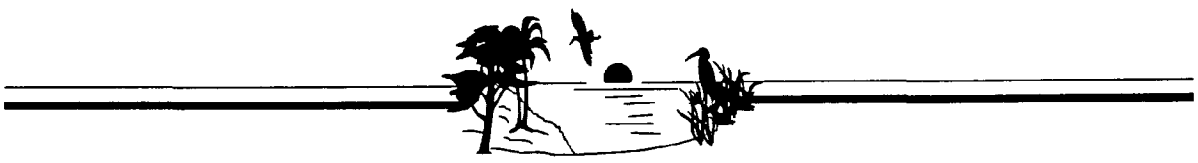
tank leachate and drainage from urban and residential development. Land use type and intensity are strongly related to NPS concentrations.

NPS pollution is a major, largely uncontrolled, cause of surface water degradation throughout Florida (Livingston et al. 1989). In north Florida, the progression of natural ecosystems to silvicultural, agricultural, and urban uses has resulted in increased NPS pollution impacts (Livingston et al. 1989). NPS pollutants in northwest Florida include pesticides, animal wastes, nutrients, and sediments (Wolfe et al. 1988). Pesticides and other contaminants can be dangerous to the aquatic ecosystem. Water quality changes affect wildlife habitat. Increased NPS pollution could adversely impact water quality and result in its recreational and habitat values being impaired or lost.

The land use assessment provided the information necessary to estimate NPS pollution loads for each land use and land cover type within the St. Marks and Wakulla Rivers watershed. The land use acreage information was used with loading rates to estimate loads for total nitrogen (TN), total phosphorus (TP), five day biological oxygen demand (BOD5) and total suspended solids (TSS). The loading rates and NPS assessment methodology were derived from previous northwest Florida studies completed by the District (see Appendix III).

OBJECTIVES

The objective of this assessment was to estimate potential NPS loadings to the St. Marks and Wakulla Rivers. Urban and non-urban activities, including residential,



commercial and industrial development, agriculture and silviculture contribute to altered surface water quality and flows throughout the St. Marks and Wakulla Rivers watershed. These alterations in surface water characteristics may, in turn, negatively impact water quality and wildlife habitat within the St. Marks and Wakulla Rivers.

NPS loadings from individual land uses must be characterized in terms of origin, rates, and potential impacts if water quality effects are to be accurately assessed based on land use. Geographic Information Systems (GIS) enable planning and resource management agencies to model current development trends and characterize associated potential water quality impacts. The present study was designed to identify potential water quality impacts to the St. Marks and Wakulla Rivers watershed resulting from nonpoint source (NPS) pollution associated with land uses within the watershed in Wakulla, Leon and Jefferson counties.

A review of nonpoint pollution sources within a watershed is essential to improving and managing water resources. This information is necessary for developing strategies to protect receiving waters. Watershed preservation and restoration plans must address NPS loadings to watershed systems and emphasize alternatives that reduce loadings of suspended sediment, nutrients, and contaminants. Many NPS pollutants can be controlled by compliance with recommended Best Management Practices (BMPs) and associated water quality standards.

Another issue of particular concern within the watershed is its topography and karstic nature. The relationships between ground and surface water in the study area are

quite complex. These relationships have not been well documented through studies for this region. The relatively flat topography and highly karstic nature of this watershed are likely to significantly inhibit overland flow of stormwater runoff. Thus, the findings of this analysis should be verified through a water quality monitoring program and further study. A more thorough understanding of the hydrology and hydrogeology of this region would be helpful for development of water quality protection strategies.

Thus far there appear to have been no comprehensive studies that characterize the nonpoint source loading potentials within the St. Marks and Wakulla Rivers system and the existing or potential water quality effects. Nonpoint pollution estimates for existing sources have not yet been documented for this particular area and previous studies have been conducted on such a large scale that the available information is difficult to apply to this specific locale.

The information generated by this study will be accessible to the appropriate state, regional and local government entities for guidance in formulating plans, rules, regulations, resolutions and/or ordinances relating to future watershed activities. These could include future land use controls and various other NPS pollution prevention strategies.

METHODS

Existing land use and land cover within the St. Marks and Wakulla Rivers watershed were initially classified into more than 40 categories which included similar land use and land cover types. Due to the impracticality of developing and applying 40+ individual

loading rates, the original categories were aggregated into 15 categories, based on similarities in loading characteristics. Previous NPS pollution studies were reviewed to corroborate loading rate estimates for water quality parameters and land use categories (Rains, et al. 1993).

All loading rate calculations were based on local rainfall data. Rainfall data for a five-year period from the closest available rainfall stations, (Tallahassee and Wewahitchka) were used to identify a watershed average annual rainfall of 58 inches.

Loading rates for total nitrogen, total phosphorus biological oxygen demand and total suspended solids were estimated for each land use category. Total loadings were reported in pounds/year (lbs/yr). Determining whether or not NPS loading from specific land uses or areas met water quality standards was not within the scope of this study.

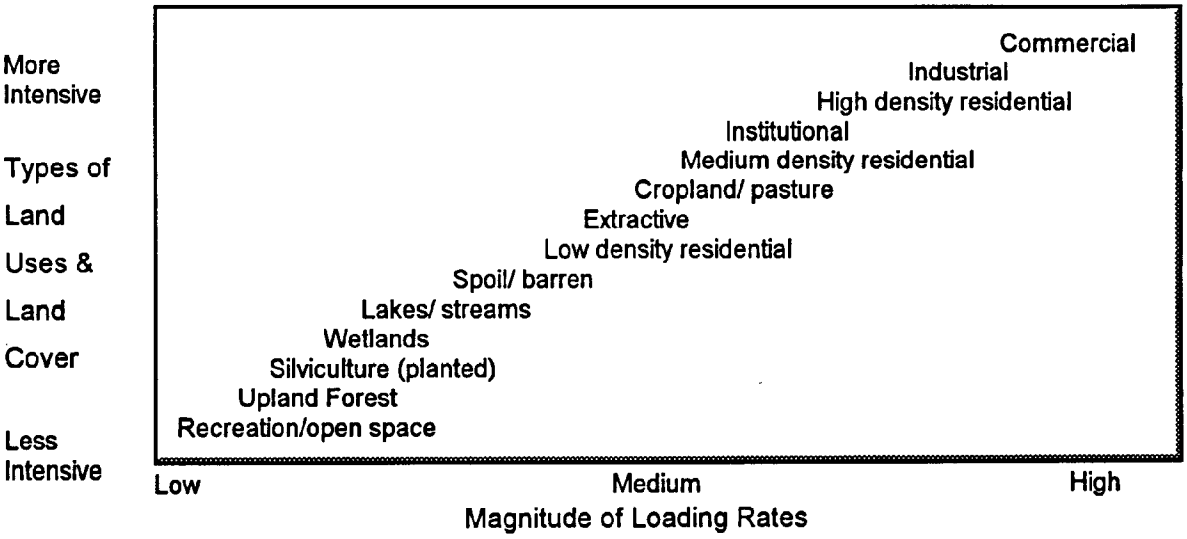
RESULTS

Generally, loading rates can be characterized by potential water quality impact per-acre as shown in Table 3. Urban uses, including commercial, industrial and high density residential, contribute the highest loadings per acre due primarily to stormwater runoff from parking areas and loading zones. Active agriculture, such as croplands also can contribute relatively high NPS loadings on a per acres basis. Less intensive uses, such as native forests, silviculture and low density residential have much lower per acre NPS loading rates.

This assessment estimated the total NPS load for each land use and land cover category based on the loading rates for each category and the amount of acreage for each category identified within the watershed. The total amount of NPS loadings for each land use is based on whether the land use loads at a high, medium or low rate and how much of that land use type is present in the watershed.

A comparison of estimated per-acre loading rates for each land use category with the land use map indicated urban land uses had the highest loadings and smallest area. Areas in non-urban land uses had the lowest per-acre estimated loading rates, but were associated with the highest total loadings, as a result of the large acreage of non-urban land.

Table 3. Relative pollutant loading rates and land uses in the St. Marks and Wakulla Rivers watershed



See Appendix III for specific loading rates

Total existing urban land use acreage accounted for approximately 7 percent of the area within the St. Marks and Wakulla Rivers watershed, but because urban uses load at a high rate, urban uses contributed more than 10 percent of the NPS loads (Appendix III, Table A-7).

Although estimated per-acre loading rates were lowest for silviculture areas, these areas included 36 percent of the acreage within the St. Marks and Wakulla Rivers watershed and thus accounted for the greatest total NPS pollutant load. Silviculture, upland forests and agriculture produced the majority of NPS loads due to the large amount of acreage for each present within the watershed. However, on a per-acre basis, silviculture and upland forests have the lowest NPS loadings. Thus, if silviculture and forest lands are converted to more intense land uses, such as agriculture or residential, the NPS pollutant load from the converted area will increase (see Table 3).

Because NPS pollution is difficult to control, the Environmental Protection Agency and the FDEP have agreed upon preventive management techniques which best protect the water resource and contribute to good overall forest and agriculture management (Florida Department of Agriculture and Consumer Services 1991). Best Management Practices (BMPs) represent a practice or combination of practices determined to be the most effective means of preventing or reducing the amount of pollution generated by these nonpoint sources to a level compatible with water quality goals. Implementation of silviculture, agriculture and urban BMPs provide a means to protect water resources quality in the St. Marks and Wakulla Rivers watershed.

The impacts of silviculture and agriculture activities can be substantially reduced if recommended BMPs are comprehensively implemented and rigorously enforced. In an effort to clarify the use and interpretation of BMPs and to make their application more consistent, Florida forestry BMPs have recently undergone substantial revision to increase water resource protection. The use of BMPs will reduce NPS loadings from silviculture. The Division of Forestry is currently reassessing compliance and effectiveness of BMPs in an effort to more accurately reflect BMP compliance.

Three general options exist for abating NPS pollution from urban activity. The options involve prevention, treatment, and control measures, implemented as an integrated abatement approach (Wanielista 1975). In brief, prevention involves practices that are applied before problems arise; treatment involves complete or partial physical, chemical, and/or biological processes for minimizing impacts of stormwater; and control measures would involve reduction or control of pollution sources.

Ideally, limiting discharges from new developments to discharge that would have occurred under natural, undeveloped conditions, in addition to maintaining water quality standards, should result in no increases in NPS pollution.

Conclusions

Over the past ten years, there has been a 40 percent decline in water quality monitoring of stream reaches in Florida (Hand and Paulic 1992). This downward trend in monitoring threatens the ability to accurately assess the quality of Florida waters and

emphasizes the need for more water quality data. The availability of site-specific loading rates in the St. Marks and Wakulla Rivers watershed and northwest Florida in general would provide the information necessary to more accurately estimate total NPS loadings to the watershed.

Results of this study emphasize the importance of controlling NPS pollution in both urban and non-urban settings. As expected, potential water quality impacts per-acre were greatest for the transportation/utilities, commercial, industrial, and high density residential urban land use categories. Although loading rates for non-urban categories were comparatively low on a per-acre basis, silviculture and agriculture practices may adversely impact quality in the St. Marks and Wakulla Rivers watershed.

The methodology described in this assessment integrated GIS, satellite imagery, land use plans, and land use/cover maps to model existing land use development patterns. GIS technology can also provide the means of using comprehensive plan future land use maps interactively with existing land use/cover data so location, type, and quantity of NPS loadings can be projected for future scenarios. The GIS can assist in estimating potential NPS loadings resulting from urban development designated by the comprehensive plan future land use map. The information and maps resulting from this assessment the regarding the relative intensity, size, and location of NPS pollution that can be made available to reviewing agencies and local officials.

The methodology used in this study is intended for use by state, regional and local agencies in developing and implementing strategies to reduce NPS loadings in the watershed. The project methodology provides a framework for the development and

implementation of pollution load reduction goals, total maximum daily loads, best management practices, land development regulations, land preservation and acquisition, water quality protection and watershed management goals. Targeting stormwater treatment and compliance with recommended forestry, agriculture and urban best management practices would reduce NPS loadings into St. Marks and Wakulla Rivers and ultimately Apalachee Bay. These efforts should include education for homeowners regarding BMPs.

The St. Marks and Wakulla Rivers land use and nonpoint source assessment should be used by local governments in their planning and development review processes. In areas proposed for development, the existing land use map can be used as the first step in performing a land suitability analysis. Local governments can identify specific existing land use/ land cover categories to be used as "red flags" when these land cover types occur in an area proposed for development. Any proposed land use change should consider NPS impacts which may occur from the new land use. Maintaining native forests and well managed silviculture uses will result in lower NPS loads than if these lands are converted to agriculture or urban uses.

Local governments can minimize nonpoint pollution through growth management. Local government comprehensive plans address land use by designating future land uses, while development regulations address ways the land may be developed within each particular land use category. Land use designations in local government comprehensive plans should reflect the future land uses that local governments believe will serve the future needs of its jurisdiction. The reasons for designating a given parcel or area under a particular future land use category can be quite varied, and typically include

consideration of criteria such as the physical features of the land, including development constraints; access to services such as schools, roads, sewers, and central water systems; and location in relationship to urban areas. Local governments may want to preserve the rural character of certain areas or may want to encourage urbanization of fringe areas around existing urban centers.

Local government comprehensive plans should include density and land use restrictions which allow only land uses which are compatible with protecting natural resources and water quality within the greenway. One way this can be accomplished is by designating the greenway as a special conservation area on the Future Land Use Map and controlling land use to protect the greenway. Commercial, industrial, and high-density residential uses may not be appropriate for these areas based on high NPS pollution loading potential of these uses.

When designating future land uses for riverine areas within the watershed, the effect of such designations upon the water resources and quality must be considered. Future land use designations which restrict development for the purpose of protecting water resources and wildlife habitat are clearly in the public interest. Requests to change watershed land use designations to allow more intense uses must be carefully reviewed for possible impacts to the resources.

Because of the impacts likely to result from land use conversions, it is recommended that the intensity of land uses within the St. Marks and Wakulla Rivers watershed not be increased in the local comprehensive plans. Retaining lands in

silviculture and very low-density rural residential uses (in the future) will have the least impact on water quality. Because of the higher loading rates associated with agricultural uses, conversions of use from silviculture to agriculture should also be strongly discouraged. Local and state governments should provide economic incentives to private landowners to retain low intensity land uses to help minimize nonpoint source water pollution.

The information from this assessment should also be used as baseline data for measuring land use conversions in the watershed. Similar land use assessments could be performed at specific intervals (every five to ten years would be appropriate) to accurately document changes in land use which could impact St. Marks and Wakulla Rivers. These assessments can also provide information which should be used to verify past projections of land development patterns and to help predict future patterns. Nonpoint source pollution loading models should be updated and verified following each land use assessment.

Land development regulations (LDRs) are ordinances of local government which prescribe various conditions which must be adhered to during the development process. LDRs typically address issues such as lot coverage, setbacks, stormwater control, buffers, septic system requirements, flood protection, wetlands preservation, and construction management practices. LDRs also often include additional restrictions for activities in specific geographic areas, such as greenways, which could impact resources that are particularly sensitive, such as rivers, habitat areas and large wetland systems.

Development and implementation of local land development regulations are critical to protecting greenways, since urban activity usually alters the magnitude and effects of hydrology and pollutant loads by increasing impervious areas. Such flooding and stormwater loading problems require that preventive land management measures be an integral part of urban development plans.

Further Studies

Ideally, regional loading rates should be researched and applied to establish site-specific loadings in future studies. The surface water flow patterns and karstic geology within watershed also should be studied to identify relationships between ground and surface waters and any implications for NPS pollution estimation and management.

Literature-based loading rates provide a means of estimating NPS loads. Water quality sampling to establish local loading rates is, however, preferable. Although estimates of NPS loadings based on general runoff water quality data is the least expensive because it requires no field data collection, its accuracy is difficult to verify. Runoff monitoring methods provide best estimates of existing loads, but cannot be used to predict load changes of a changing urban system (Marsalek 1991). The success of simulation models using either of these methods depend on successful calibration.

A comparison of estimated NPS loading values and actual water quality data should be conducted to assess the applicability of the literature-based NPS loading methodology. Future studies, modelling and mapping should also consider such factors as floodplains

in estimating NPS loadings and rate coefficients.

Further studies are necessary to implement Pollution Load Reduction Goals (PLRG) and Total Maximum Daily Loads (TMDL). The term TMDL is the end result of a process applied by FDEP and EPA to limit total pollutant loadings discharged into a waterbody to protect critical biological, chemical and physical attributes and maintain the designated use of the waterbody (US EPA 1991).

Intergovernmental Coordination and Implementation

State and local governments should take a proactive role in securing funds to undertake stormwater planning and implementation and implement long-term monitoring of NPS pollution and BMP effectiveness.

St. Marks and Wakulla Rivers Resource Inventory

Natural Resources of the Watershed

Geography & Hydrology of the St. Marks River

The St. Marks River drains 1,180 square miles in the eastern portions Leon and Wakulla counties including eastern Tallahassee, western Jefferson County and southern Thomas County in Georgia (Hand and Paulic 1992 b). The Project' s study area focuses on the portion of the watershed in southern Jefferson, eastern Leon, and Wakulla counties. The St. Marks River flows for 35 miles in Florida before it empties into Apalachee Bay at the Gulf of Mexico. It originates in the north Florida / south Georgia Red Hills Region where the soils are principally clayey-sand. The river is classified as blackwater river. Upstream the river is suspected to be influenced more by overland flow from rainfall (surface water) than by groundwater. The region receives an average of 60 inches of precipitation annually. July is the wettest month with periods of high rain from February to March (FNAI and FDNR 1990).

What is Karst topography?

Carbonate rocks, such as limestone and dolomite are highly vulnerable to chemical weathering and erosion. The distinctive landforms and unique drainage characteristics that result from this weathering are termed karst.

Karst topography including sinkholes, springs, wet/dry depressions, sinkhole lakes and swallow holes (disappearing streams) are common features of limestone and dolomite terrains. Karst features can provide a direct conduit for the introduction of contaminants into the Floridan Aquifer. ❖

Figure 7

The St. Marks river has, however, many unique features not typical of a blackwater river. As the St. Marks River flows over the Woodville Karst Plain, it is influenced by many springs and the limestone rock it flows over (Hand and Paulic 1992; and FDNR 1989). The central and southern reaches of the river flow over the Cody Scarp and the Woodville Karst Plain where the underlying limestone lies close to the surface (Hand and Paulic 1992b). Many springs and sink holes are scattered throughout this area, including many small streams that often flow on the surface for short distances before they disappear into sinks or swallowholes. The river is influenced by groundwater and surface water in these two areas.

Horn Spring and Rhodes Spring are the first major springs along the St. Marks River north of Natural Bridge. At Natural Bridge during normal flow, the St. Marks River flows underground and rises up at St. Marks Spring about one mile south where the water loses much of its dark appearance. The average flow of the St. Marks Spring is 700 cubic feet of water per second (FDNR 1989). From this point on, the St. Marks River begins to resemble a spring fed river flowing 11 miles south to the confluence with the Wakulla River at the Fort San Marcos de Apalachee in the City of St. Marks (for characteristics of spring fed rivers refer to the following section on the Wakulla River). A few smaller springs, such as Newport Spring, feed the river south of the rise. The improved clarity and increase in pH provides better conditions for aquatic plant growth and a more productive fishery in this portion of the river.

Water Quality of the St. Marks River

Water quality is excellent in much of the watershed; however many reaches of the St. Marks River have not been sampled recently (Hand and Paulic 1992b). The portion of the St. Marks River adjacent to the port Town of St. Marks exhibits a number of water quality problems. The section on the northeast end of town from Rattlesnake Branch to the confluence with the Wakulla River on the southwest end of town is influenced by tank farms and barges, a power plant, marinas, waste water effluent and urban stormwater runoff. There have been several major and minor oil spills in the past, and the river bottom sediments in the area are coated with oil (Hand and Paulic 1992b). The St. Marks River is designated as Outstanding Florida Water (OFW) body except for this portion of the river. The OFW designation allows for no further degradation in water quality and is the State of Florida's highest designation of quality for natural water bodies.

Ecology of the St. Marks River

The St. Marks River originates in the hardwood and cypress river swamps in north Florida and a small portion of south Georgia. Rivers, such as the St. Marks, which originate from swamps and bottomland forests are known as blackwater rivers (Ewell 1990). Blackwater rivers originate in areas where there are sandy lowland areas with extensive wetlands with organic soils. These wetlands function as reservoirs, collecting water and overland flow and discharging it into the stream (FNAI and FDNR 1990). The dark tea-colored water originates from the natural organic acids (tannins) resulting from the decay of leaf litter and other organics found in river hardwood and cypress swamps. The water tends to be naturally acidic with a pH of 4.5 to 5.5.. The pH increases as the

St. Marks flows through underground caverns downstream at Natural Bridge. The dark water tends to limit aquatic plant growth on the river bottom, however, emergent aquatic plant growth is prevalent along the banks.

The intact bottomland hardwood forest and river swamp corridors along the St. Marks River moderates stream flow and the magnitude of flooding by providing overflow areas for floodwaters to disperse. Streamside vegetation slows flood waters and upland storm water run-off while dispersing the energy associated with the moving water which reduces erosion. The leaf litter and other organic debris associated with the riparian ecosystem combine to form soils that are very porous. These loamy soils act as a sponge to soak up rain water, then slowly release the water back into the riverine system. Vegetation impedes run-off causing it to slow down while increasing infiltration of water into the soils.

The upper reaches of these rivers are influenced by natural stormwater runoff flow and groundwater seepage. The groundwater may contribute to the river flow as much as rainfall, especially in the areas where Karst topography exists (Ewell 1990). These high water table forests experience occasional flooding during heavy rains. The St. Marks River at peak floods often flows over Natural Bridge, flooding much of the surrounding bottomland forest.

The St. Marks River is lined with hardwood and cypress swamps much of entire length of the river, except in areas of silvicultural harvesting and residential development. The associated bottomland forest directly adjacent to the river is characterized by tall hardwood trees such as oaks, maples, elms, and American Beech. Other bottomland

forest trees include Loblolly Bay, Southern Magnolia, Swamp Tupelo, Bald Cypress and Sweet Gum. Typical animals found in bottomland forest include the Marbled Salamander, Cotton Mouth Water Moccasin, Eastern Screech Owl, Gray Fox, and White Tailed Deer (FNAI, 1990). Many animal species use the linear nature of these bottomlands for migration and reproduction. Migrating ducks such as the Mallard and Black Ducks often winter in river swamps where they feed on acorns and hickory nuts in the floodplain (Wharton et al. 1977). Listed species that inhabit the river corridor include the endangered Wood Stork, the threatened Bald Eagle, Florida Black Bear, Red - cockaded Woodpecker and species of special concern such as the Limpkin, Osprey, and the Suwannee Bass (FDNR 1989).

Geography - Hydrology of the Wakulla River

The Wakulla River rises from Wakulla Springs and the Floridan Aquifer at Edward Ball Wakulla Springs State Park about 12 miles south of Tallahassee. Wakulla Springs, a first magnitude spring, is one of Florida's highest volume springs providing most of the Wakulla River's average 400 cubic feet per second flow (Hand and Paulic 1992). The Wakulla River flows south for ten miles, to the confluence of the St. Marks River at the port Town of St. Marks. The mineral laden waters originating from deep springs are often devoid of sediments and have a pH of 7.0 to 8.2 (FNAI and FDNR 1990). The clear, cool waters are very conducive for plant growth and other aquatic life.

Wakulla Springs is in the south-central part of the St. Marks basin which is in a highly karstic region of Wakulla County. There are numerous sinks and streams that disappear into the ground to the north and west of the spring. It is widely speculated that there is a strong relationship between the surface waters entering the sinks to the north

and the outflow of the springs (Hand and Paulic 1992). These relationships are being researched by the Woodville Karst Plain Project.

Water Quality of the Wakulla River

The Wakulla River is designated an Outstanding Florida Water body by the Florida Department of Environmental Protection. The river has outstanding water quality in the springs and upstream segments (Hand and Paulic 1992 b). However, the water quality index is unknown as of the 1992 Florida Water Quality Assessment 305 (b) Report. Both the Florida Rivers Assessment and the 305 (b) report state that the lower portion of the Wakulla River is threatened by increased growth along the river and lack of adequate buffers along the Wakulla's banks (Hand and Paulic 1992b; FDNR 1989). The lower section of the Wakulla River near the port town of St. Marks has increased algae growth probably resulting from industrial and domestic pollution and nutrient sources (FDNR 1989).

Ecology of the Wakulla River

The Wakulla River is fairly unique to the Panhandle of Florida, because it is one of a few spring fed rivers in northern Florida. Most of Florida's spring fed rivers occur in central and south Florida. There are three different plant communities associated with the Wakulla River. Most of the Wakulla River is lined with a river swamp/bottomland hardwood forest similar to the St. Marks River, although Bald Cypress, Black Gum, and Tupelo trees are more prevalent along the Wakulla River. Upstream the river is lined with cypress and hardwood river swamps, mid stream the river swamps gradually give way to

freshwater tidal swamps and near the river's confluence with the St. Marks River, salt marshes begin to appear along the river's edge. In areas where development has occurred, the river swamp has been filled or modified.

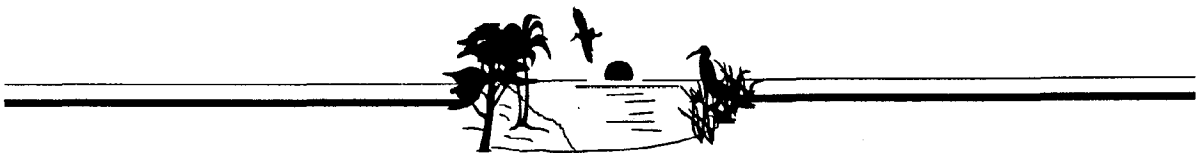
Many species of water birds inhabitant the Wakulla River, including the largest and most northern breeding colony of Limpkins. The Limpkin is a species of special concern and is endemic to Florida's spring fed rivers where it feeds on various freshwater snails. Other wading birds inhabiting the river include the Little Blue Heron, Great Blue Heron, White Ibis, Snowy Egret, Tricolor Herons. Other birds found include migratory waterfowl, warblers (Prothonotary, Hooded, Kentucky, and Northern Parula), and the Wakulla Seaside Sparrow. Other animals inhabiting the Wakulla River include the American Alligator and the threatened Bald Eagle and the endangered West Indian Manatee (FDNR 1989). Protected animal species include the Florida Black Bear and the Eastern Indigo Snake. The unique Woodville Cave Crayfish can be found in the underwater caves along the river. Wakulla Springs State Park has preserved habitat for numerous rare and endangered plants. There are over a dozen rare and endangered ferns and orchids found within the protected boundaries of Wakulla Springs State Park (FDNR 1989).

South of the US Highway 98 bridge, the Wakulla River is influenced by the daily tides of Apalachee Bay and the Gulf of Mexico. The ecosystems associated with tidal areas are known as freshwater tidal swamps. The freshwater tidal swamps along the Wakulla River are comprised of Bald Cypress, Tupelo, Cabbage Palm, Sweet Bay Magnolia and Black Gum (Wharton et al 1977).

The Wakulla River flows into the St. Marks River at the Town of St. Marks. The St. Marks River then flows for three miles through the St. Marks National Wildlife Refuge before emptying into Apalachee Bay. The surrounding lands are primarily salt marshes dotted with pine flatwoods islands. The expansive salt marshes of the St .Marks National Wildlife Refuge are a part of the vast salt marshes which stretch approximately 200 miles from Cedar Key to the Ochlockonee Bay (Clewell 1986; FDNR 1989). This nearly beachless coastline is due to the shallow waters and seagrass flats of Gulf of Mexico which absorbs much of the wave energy before it reaches the shoreline (Clewell 1986). These smaller waves do not have the energy to move enough sediment for beach and island formation, but they do allow the creation of the salt marshes.

Recreational Resources of the Watershed

Most of the recreational and economic opportunities of the watershed are closely linked to the natural features and beauty of the Wakulla and St. Marks rivers. The watershed includes many natural features such as the Wakulla Springs and the Leon Sinks Geological Area in the Apalachicola National Forest. The watershed's natural resources draw visitors into the outdoors for fishing, hunting, hiking, swimming, horse-back riding, off-road bicycling, in-line skating, canoeing, and manatee watching. There are numerous trails, parks and quiet areas to spend the afternoon or a few nights in the wilderness (see Figure 8 - St. Marks and Wakulla Rivers Recreational, Historic and Cultural Features). The Florida Greenways Program maintains a database that contains information on the resources found within the region which is available upon request. The following describes the trails, parks and historic sites that are found within the watershed.



St Marks and Wakulla Rivers Recreational, Historic and Cultural Features

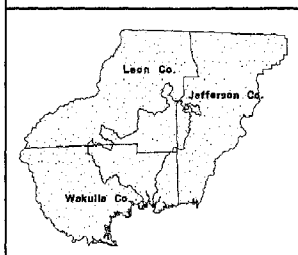


Figure 8

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September 1994

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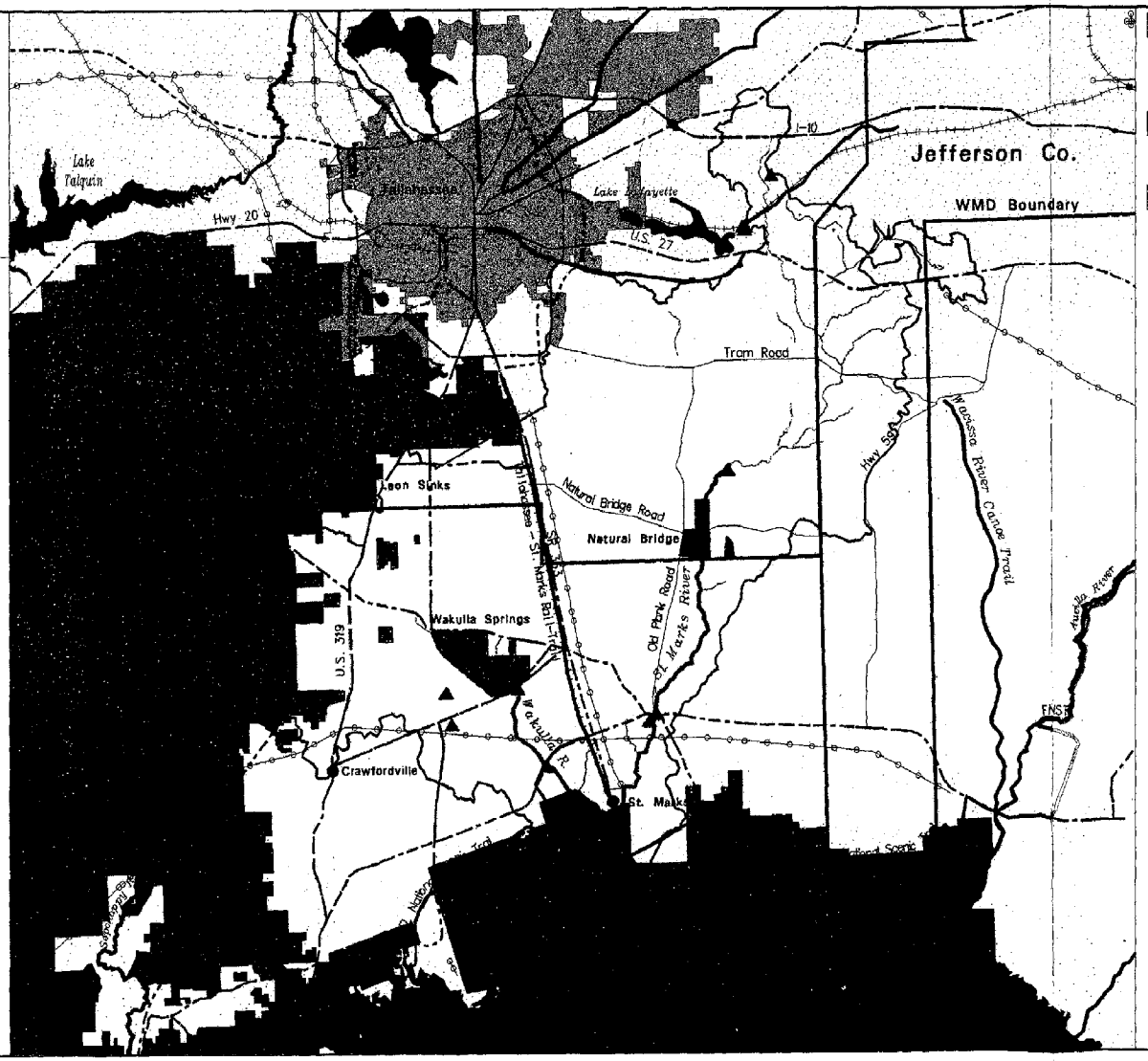
Florida Greenways

FRIENDS 1000 FLORIDA

Northwest Florida Water Management District
N.W.F.W.M.D



- City of Tallahassee
- Public Lands
- CARL Lands (Proposed)
- Watershed Boundary
- Major Roads
- Transmission Lines
- County & WMD Boundary
- Proposed Trails
- Existing Trails
- Canoe Trails
- Historic Features
- Natural Features
- Recreational Features

Florida National Scenic Trail

The Florida National Scenic Trail (FNST) meanders for 100 miles through the southern portion of the watershed as it travels through the St. Marks National Wildlife Refuge and the Apalachicola National Forest. It crosses the St. Marks River at the port Town of St. Marks which is located at the southern end of the Tallahassee-St. Marks Historic Railroad State Trail. There is no bridge constructed to cross the river, but hikers often find friendly boaters or they make arrangements with a local marina to ferry them across the river. The FNST is co-located for 2.5 miles with the Tallahassee-St. Marks Historic Railroad State Trail. The trail continues two miles west along US Highway 98 where it heads over the Wakulla River on the highway bridge before re-entering the Refuge. The Florida Trail must be removed from the US Highway 98 right of way if it is to be eligible for designation as part of the Florida National Scenic Trail. The FNST in the Refuge is designated as a hiking trail, but it is a multi-use trail where it joins with the rail trail. Use data for the FNST has not been collected, but it is actively maintained and used by the volunteer members of the Florida Trail Association.

Tallahassee- St. Marks Historic Railroad State Trail

The Tallahassee-St. Marks Historic Railroad State Trail is the State of Florida's (DEP) first rail trail. The beginning point for most trail users is the Capital Circle Trailhead located just south of Tallahassee on State Road 363. The trail follows Florida's oldest rail line (operating from 1837 to 1984 as the Tallahassee-St. Marks Railroad) for sixteen miles to the port Town of St. Marks (FDEP 1994). Since its opening the trail has been very

popular, receiving up to 170,000 bicyclists, walkers, skaters, and equestrians annually (Moore et al 1992). The Munson Hills off-road bicycling trail is located off the rail-trail one mile south of the Capital Circle trail-head. Southern Trail Riders maintains a horse trail adjacent to the rail-trail. Popular activities on the paved portion of the trail include bicycling, walking and in-line skating. Bicycles and in-line skates can be rented at the Capital Circle trail head. Water fountains can be found along the trail and refreshments and restrooms are found at each end of the trail.

Georgia, Florida and Alabama Rail Trail

The proposed 53 mile long Georgia, Florida and Alabama (GF&A) Rail Trail is in the early stages of planning. The US Forest Service is currently studying the proposed route for its environmental and social impacts under the National Environmental Policy Act (NEPA). Once completed the GF&A Rail Trail will connect Tallahassee to Sopchoppy in Wakulla County and Carrabelle on the Gulf of Mexico in Franklin County. The trail skirts the northwestern boundary of the Wakulla River basin in the Apalachicola National Forest.

Wakulla River Canoe Trail

The Wakulla River is a state designated canoe trail used by thousands of people for canoeing, manatee watching, and fishing. TNT Hideaway Canoe Rentals, located at the U.S. 98 bridge, reports renting nearly 2,000 canoes annually for use on the Wakulla River. There is public access at the Upper Bridge on SR 365, the Lower Bridge on US Highway 98, hand-launching at the St. Marks Town Park just upstream of the Fort, and the

public boat ramp adjacent to the Fort San Marcos de Apalache State Historic Site in port Town of St. Marks. The Shell Island Fish Camp provides river access at its private boatramp. Canoe rental, shuttle and guide services are available by reservation from the Canoe Shop in Tallahassee and from Gulf Coast Excursions in Panacea. Restrooms and drinking water are available at the fort, TNT Hideaway Canoe Rental and the St. Marks Town Park. Olin Corporation manages a private park and picnic area for its employees along the Wakulla River; 1/2 mile downstream form the U.S. 98 bridge.

St. Marks River

The St. Marks River although not designated as a state canoe trail, but it offers an enjoyable paddle having limited motorboat traffic upstream of the US Highway 98 bridge. The St. Marks River can be accessed at the US Highway 98 Bridge in Newport from the boat ramp and park managed by the Florida Department of Agriculture's Florida Forest Service. The park also offers overnight camping.

Big Bend Historic Saltwater Paddling Trail

The state designated Big Bend Historic Saltwater Paddling Trail follows salt marshes and shallow bays for nearly 150 miles along the Gulf Coast from the St. Marks National Wildlife Refuge to the mouth of the Suwannee River. The trail is not currently marked and there are few developed facilities along its route. Publication of a guidebook describing the trail is planned for 1995.

The Apalachicola National Forest

The Apalachicola National Forest is Florida's largest national forest with 563,986 acres of which 32,000 acres are designated as Wilderness (USDA Forest Service 1994). The eastern portion of the Forest in the Wakulla Ranger District lies within the St. Marks watershed. There are over 680 active Red-cockaded Woodpecker colonies within the forest, making it one of the largest populations of Red-cockaded Woodpeckers in the United States. The Apalachicola National Forest supports a wide variety of recreational opportunities including hunting, fishing, hiking, horse-back riding, canoeing, camping and off- road bicycling. There are 15 developed areas for recreation scattered throughout the Apalachicola National Forest with most of them situated on a lake or a river. There are over 120 miles of hiking and horse trails in the forest (US Forest Service 1994). There were 538,000 visitors enjoying the Apalachicola National Forest in 1993.

The Leon Sinks Geological Area is located in the eastern portion of the Apalachicola National Forest along S.R. 363 near the Leon-Wakulla County line. Leon Sinks has many karst features including wet and dry sinkholes and stream disappearing into a swallohole. There are two loop trails totalling 5.9 miles taking visitors past these unique sink holes, turkey oak scrub habitat, river swamps and pine flatwoods. These trails are open for hikers only. Water and restrooms are available on site.

The St. Marks National Wildlife Refuge

The St. Marks National Wildlife Refuge comprises the entire coastal salt marsh section of the St. Marks Basin. The Refuge is approximately 65,000 acres of saltmarsh, pinelands, turkey oak scrub, and hydric hammocks. The historic St. Marks lighthouse is located at the point near the mouth of the St. Marks River in the Refuge. There is a public boat ramp near the lighthouse. Mounds Pool and Stony Bayou Trail is located along the dike system surrounding the fresh water pools and marshes at the Refuge. The trails are open year round to bicycling, horseback riding and hiking. Bird watching is especially popular from the trails. Many waterfowl can be observed feeding in the fresh water pools and the salt marshes. Small boats and canoes with up to ten horsepower motors are permitted in the pools from March 15 to October 15. The Refuge provides bird watchers, bicyclists, equestrians and hikers many opportunities to see an abundance of wildlife. The Refuge had over 250,000 visitors in 1993.

Edward Ball Wakulla Springs State Park

The 1,500 acre Wakulla Springs State Park surrounds the headwaters of the Wakulla River (FDEP 1994). Picnicking, swimming and snorkeling are popular activities in the park near the head spring. Boat tours are available for tours of the river within the park. Hiking and nature trails also wind through the park's uplands and lowlands. Wakulla Springs State Park is listed on the National Register of Historic Places, and there are several historic structures including a 27-room inn and conference center. The historic lodge was constructed in 1937 by Edward Ball and is now operated as a conference center by Florida State University (FDEP 1994). In 1993, nearly 150,000 people visited the park.

Natural Bridge Battlefield State Historic Site

Natural Bridge Battlefield State Historic Site is located at the natural land bridge where the St. Marks River flows underground in southern Leon County. This historic site commemorates a Civil War battle on March 6, 1865. Tallahassee never fell into the Union's hands as a result of the battle. The Battle of Natural Bridge is re-enacted annually at this site. Nearly 16,000 people visited the historic site in 1993.

Fort San Marcos de Apalache State Historic Site

The Spanish Constructed the fort in 1679, at the confluence of the St. Marks and Wakulla Rivers, to control the passage of ships up the rivers and establish a foothold in the region A museum and guided tours are available on the site. There is a picnic area and nature trail at the fort. The Town of St. Marks maintains a public boat ramp adjacent to the fort on the St. Marks River. In 1993, nearly 12,000 people visited Fort San Marcos.

Other Opportunities

The many rural highways in the watershed allow bicyclists the opportunity to tour the watershed's's historical sites and recreational parks. Rural canopy roads in the northern part of the watershed offer tree-shaded touring. East of Williams Road Old St. Augustine is an unpaved canopy road suitable for an enjoyable afternoon of off-road bicycling. Old St. Augustine skirts the watershed's northern boundaries .

The Economic Benefits of Ecotourism in the Watershed

The economic impact of outdoor, resource-based recreation can be substantial. Hundreds of thousand of people use the St. Marks and Wakulla rivers watershed for outdoor recreation and spend millions of dollars on equipment, food and other supplies to pursue their preferred outdoor activities. The national forest and national Wildlife Refuge provide habitat for a wide array of plants and animals. These parks with their many trails draw thousands of people to the region for their outdoor recreation opportunities. Data have been compiled on recreational use of the larger park units. Limited data are available for the canoe trails and the Florida National Scenic Trail. Table 4 provides the use data for the listed parks and trails.

Table 4 - Recreational Use for Selected Areas in the Watershed in 1993

Area or Trail Name	Number of Visitors
Apalachicola National Forest [1]	538,000
St. Marks National Wildlife Refuge [2]	256,658 total visits 25,250 hiking visits
Tallahassee - St. Marks Historic State Trail [3]	170,000
Natural Bridge Battlefield State Historic Site [4]	15,813
Fort San Marcos de Apalachee State Historic Site [4]	11,935
Edward Ball Wakulla Springs State Park [4]	142,262
Total Visits	**1,134,668**

Sources:

1 National Forest in Florida Forest Facts 1993 - visitor days. One visitor day is one person visiting for a 12 hour stay.

2 St. Marks National Wildlife Refuge, US Fish and Wildlife Service 1994.

3 Economic Impacts of Rail Trails, Moore et al, 1992.

4 Florida Department of Environmental Protection, Division of Recreation and Parks 1994. Data are from 1993/1994 fiscal year.

Demographic data collected from the St. Marks National Wildlife Refuge indicates that 41 percent of the visitors came from the local area. The local area is defined as the area within a two hour driving radius from the Refuge Visitor Center which is located near Newport. This means that 59 percent of the visitors are tourist. These data suggest that a relatively high number of the watershed's's resource users are visitors from outside the region.. Further research needs to be undertaken to quantify the number of tourist who use the resources as well as the dollars spent in the Apalachee Region as a result of the Refuge, the Forest and other parks.

Visitor use data were gathered for the watershed's parks (see Figure 9 - Comparative Use Trends) for a five year period and the trend indicates visitor use for the parks and trails is increasing or the same people are using these areas more frequently. Either way, the resources are being used by an increasing number of people on a more frequent basis. This suggests more money may also be spent on equipment rentals/ purchases, food, souvenirs, and lodging.

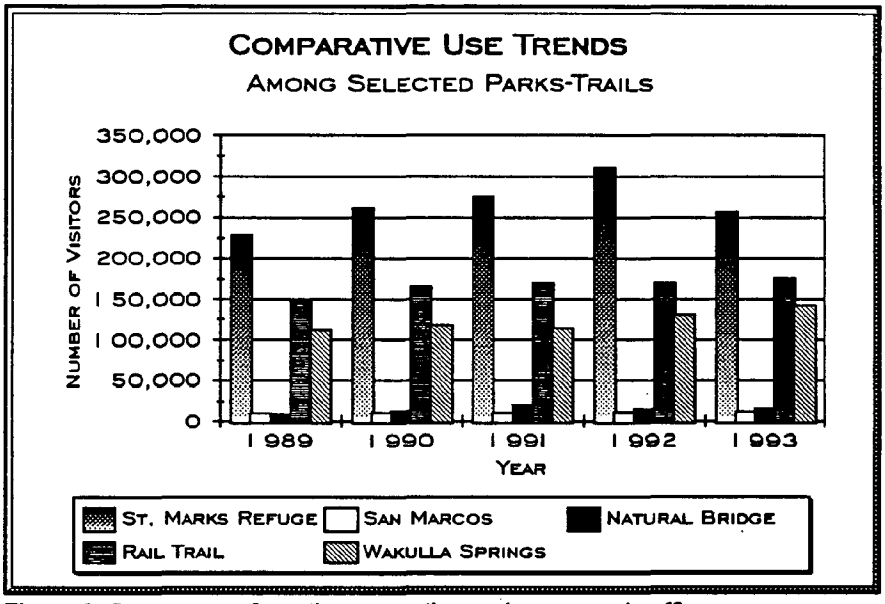


Figure 9, Sources are from the respective park manager's offices

The Tallahassee - St. Marks Historic Railroad State Trail has been studied documents its economic impacts on the community. The results of these studies indicate

that the average visitor to the Trail spends $11.00 dollars per person per day. This results in a total annual economic impact of over $1.2 million dollars with $400,000 dollars generated from tourist (Moore et al 1992). The Economic Impacts of Rail Trails further indicated expenditures on durable goods related to the trail ranged from $130 to $250 dollars. These figures are only for the Tallahassee - St. Marks Historic Railroad State Trail. The total economic impact of all the natural outdoor recreation activities is assumed to be even greater.

Fishing is also a significant use of the rivers and the Apalachee Bay. The finfish and shellfish industry is probably the greatest beneficiary of efforts to conserving the greenway in the St. Marks Watershed. The rivers, and ultimately, Apalachee Bay, are the sinks for all the water flowing off the land in the watershed's. Alterations to water quality and river hydrology can negatively impact these fisheries through loss of habitat and other changes to the aquatic ecosystems.

Frederick Bell, a noted economist studying saltwater fishing in Florida, stated that recreational fishing may be as economically important or more important than commercial fishing in the St. Marks Watershed (Bell 1994). Bell's 1993 report on Current and Projected Tourist Demand for Saltwater Recreational Fisheries is the most complete analysis of recreational saltwater fishing for Florida. This report indicates that the average visitor engaging in saltwater fishing spends $110 daily. The annual impact of the activity on Florida's economy was in excess of $1 billion in 1991 with an additional $62 million in taxes (Bell 1993). Data are not currently available on the economic impact of recreational fishing in the St. Marks, however, Shields Marina reports that an average of 15 to 20 boats use the ramp facilities at their marina on weekdays and 80 to 100 boats are launched on

weekends. Shell Island Fish Camp reports an average of 8 to 10 boats launch on the Wakulla River during the week and 15 to 20 on weekends. Most of these boats are recreational fisherman fishing Apalachee Bay and the waters inside the Refuge. Further study of the recreational fishery needs to be conducted to determine the fisheries economic impacts on the community.

According to the "1992 Annual Landings Summary" of the Marine Fisheries Division of the Florida Department of Environmental Protection, 1,626,656 pounds of finfish were brought in Wakulla County ports that year with a dockside value of $80 million. This included 1,005,781 pounds of Black Mullet (62 percent of the catch being caught in over 2,000 trips). The commercial shellfish harvest totaled 1,580,958 pounds, not including shrimp. The shrimp harvest amounted to 33,501 pounds with brown and white shrimp comprising the bulk of the harvest (FDEP 1994).

CHAPTER 3

ST. MARKS AND WAKULLA RIVERS GREENWAY

CHAPTER 3 - ST. MARKS AND WAKULLA RIVERS GREENWAY

What is a Floodway?

The floodway is defined as the area where the river leaves its banks during a flood with the floodwaters having movement in the same direction as the river.

Riparian Greenways provide the opportunity for linking the benefits of preserving the floodway while maintaining or improving river water quality and facilitating economic development through ecotourism. The many acres of public lands in St. Marks River watershed, including the Wakulla River, provide outstanding recreational opportunities to complement those associated with the greenway. By conserving the natural green corridors along the rivers, recreation and scenic qualities will continue to flourish in the future.

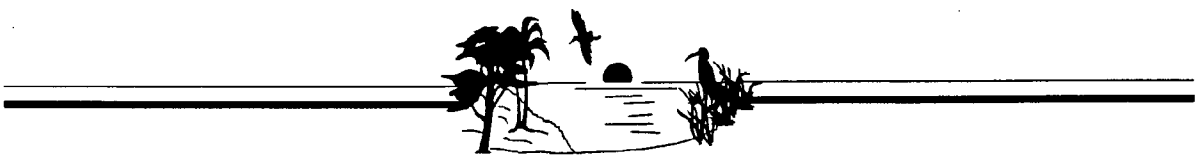
The greenway vision for the St. Marks and Wakulla rivers watershed is based upon the compilation of the land use land cover data, the Florida Game And Freshwater Fish Commission critical habitat data, existing land ownership patterns, and the recreation and cultural and historic data. The St. Marks and Wakulla Rivers Watershed Greenway map (Figure 1) results from taking the Game and Fish's critical habitat data and overlaying it with the existing land use and land cover using the GIS system. The map reflects the natural greenway corridor along the rivers (see Figure 1 Watershed Greenways).

An assessment of natural resources within the watershed was completed In order to identify the potential greenways. The objective of this assessment was to identify environmentally sensitive lands or lands with important habitat value. Each of the local comprehensive plans has policies which protect wetlands and other environmentally

sensitive lands; however, efforts to protect such lands can be limited by the lack of information regarding the location, presence or type of resources. The District's GIS was used to compile the best available resource data from several sources including the Florida Game and Fresh Water Fish Commission (FGFWFC) and Florida Natural Areas Inventory (FNAI). Compiled information included land use and land cover; strategic habitat conservation areas; and rare animal, plant and communities occurrence data. The land use and land cover information was obtain by classifying satellite imagery using the methods described elsewhere in this report.

The rare species occurrence and wildlife habitat information were obtained from several statewide geographic data sets developed by FGFWFC which incorporated FNAI data. These data were created by the FGFWFC to identify areas in need of protection in order to maintain biodiversity. This information represents the most comprehensive and detailed effort yet undertaken for this purpose in Florida (Presley 1994). These data sets also represent the best available estimate of Florida lands requiring some form of conservation to ensure that biodiversity is maintained for future generations. The FGFWFC GIS was used to assess the degree of security provided to rare species by the current system of conservation lands and to identify important habitat areas not currently protected (Cox et al., 1994). The lands recommended by FGFWFC for additional protection are referred to as "strategic habitat conservation areas". These lands are needed to meet minimum conservation goals for 30 species of wildlife inadequately protected by the current system of :

- ❖ conservation lands,
- ❖ high quality sandhill sites,



- high quality scrub sites,
- high quality pine rocklands site,
- high quality examples of tropical hardwood hammocks,
- bat maternity caves and winter roost caves,
- wetlands important to the breeding success of eight species of wading birds, and
- lands important to the long term survival of 105 globally rare species of plants.

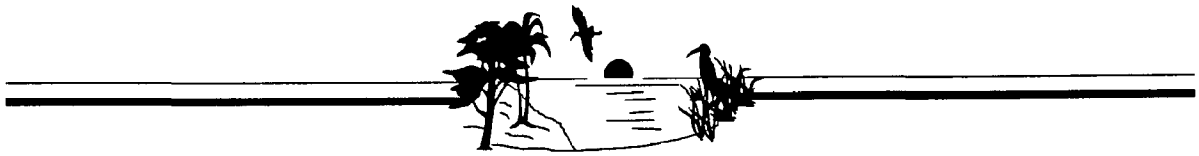
Another geographic data set was developed by FGFWFC containing known locations of many animals, plants, and natural communities. A set of maps referred to as "regional biodiversity hot spots" were created which included the following information:

- areas where large numbers of 52 selected species co-occur,
- areas supporting rare plant and wildlife communities,
- over 25,000 known locations of rare plants, animals and natural communities,
- county boundaries and conservation land boundaries, and
- coastal areas that support key components of biological diversity.

The hot spots resulted from investigation of species richness which located habitat for seven or more focal species (Class 3), five or six focal species (Class 2), and three or four focal species (Class 1) (McGrail et al. 1994). Class 1 lands were generally of lower natural resource quality than Class 2 or 3, including large tracts in silviculture and agriculture that are used by wide-ranging habitat generalists such as turkey and bobcat.

The FGFWFC data served as a starting point for the resource assessment. In order to ensure that the identification of potential greenways included the most environmentally sensitive or significant lands, the District's GIS was used to modify the FGFWFC habitat data. The FGFWFC habitat areas are shown in Figure 10 - Natural Resource Assessment Map .

The FGFWFC strategic habitat conservation areas and biodiversity hot spots (Classes 2 and 3) were combined and overlain with the land use and land cover data. In instances where habitat data coincided with non-natural land cover (such as silviculture, agriculture or urban uses), it was omitted from the lands identified as potential greenways. The remaining habitat areas which coincide with natural land cover types, are shown on Figure 10 . This was noted in the map legend since the most obvious difference between the entire and modified habitat data is the presence or absence of silviculture lands. Wetland areas identified in the land use and land cover assessment but not identified by FGFWFC as strategic habitat or Class 2 or 3 hot spots were also considered as environmentally significant lands for potential greenways (see Figure 10).



St Marks and Wakulla Rivers Watershed Natural Resource Assessment

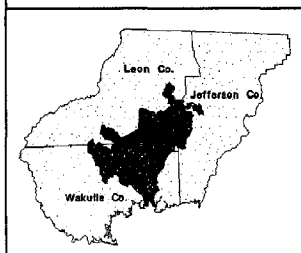
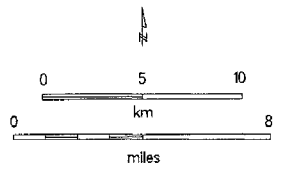
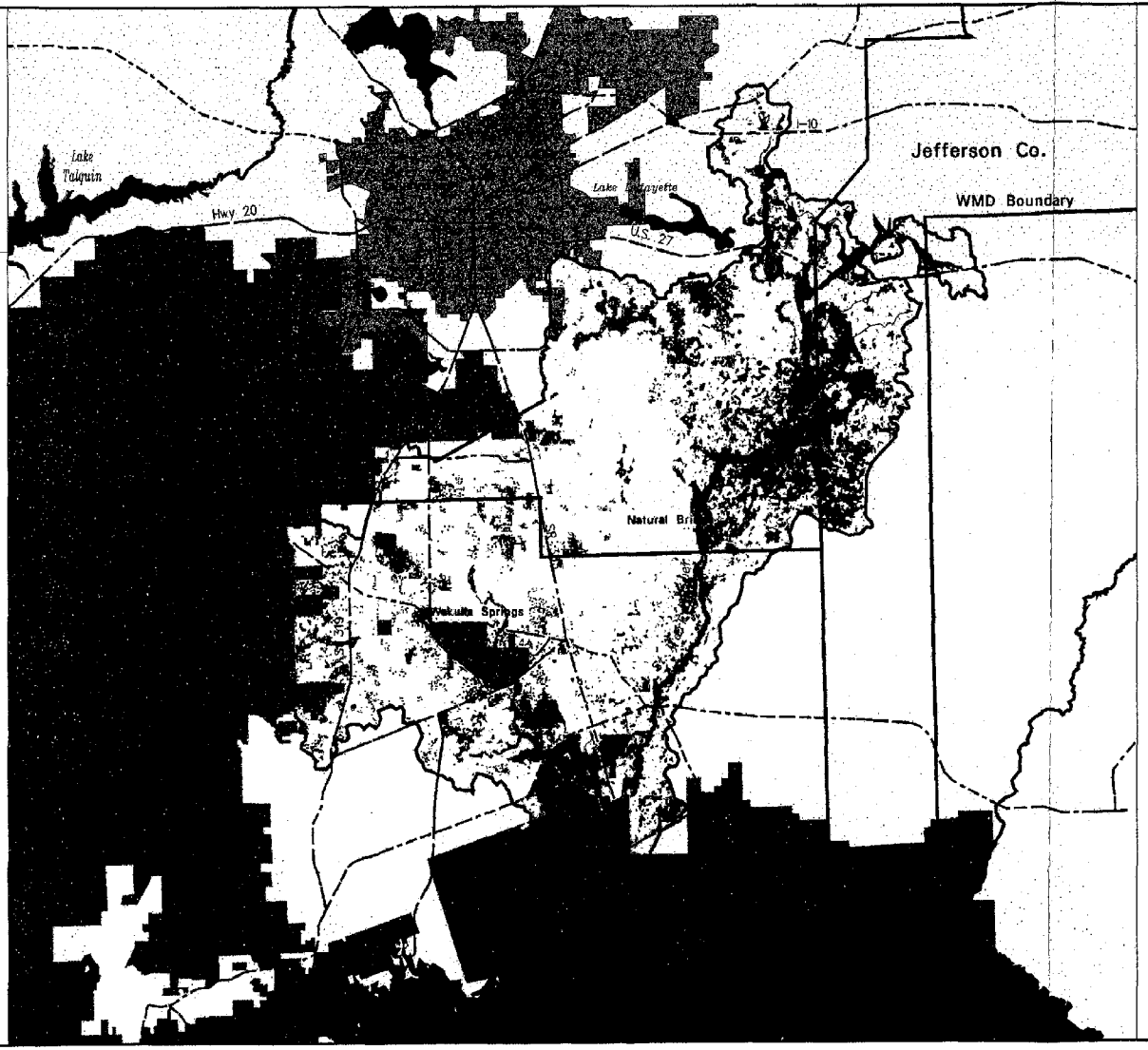


Figure 10

This publication was made possible by a subgrant from the Florida Department of Community Affairs, in cooperation with the U.S. Department of commerce, National Oceanic and Atmospheric Administration, under Cooperative Agreement Award No. NA87OZ0427. Additional funding provided by the Elizabeth Ordway Dunn Foundation and Northwest Florida Water Management District.

September 1994



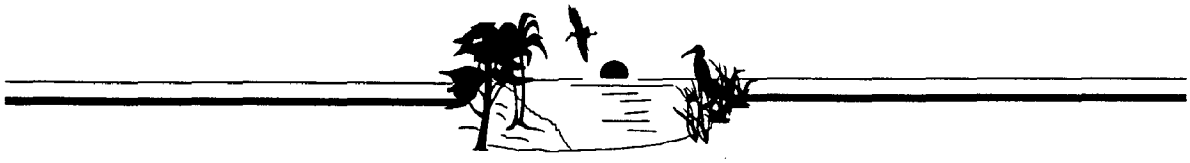


Source: Florida Game and Fresh Water Fish Commission, 1994

The FGFWFC data shows that there are extensive areas of critical habitat throughout the watershed. The modified FGFWFC habitat which coincides which natural land cover includes primarily riverine corridors and wetland areas. Additional areas of modified habitat which coincide with natural uplands forest were also identified. Although these upland areas are environmentally significant, they occupy more isolated or scattered areas limiting their function as greenway linkages. The wetlands identified by the District may also contain focal species habitat (less than 5 focal species). These areas identify additional potential greenway "spurs". The proposed greenway corridor is the unifying linkages between the largest and highest quality habitat areas.

The process undertaken in this effort served to identify those areas within the St. Marks and Wakulla riverine corridors and associated wetland and habitat corridors that may be worthy of consideration as greenway linkages. The FGFWFC report could be used in a companion fashion to enhance the protection of additional strategic habitat conservation areas proximate to the proposed greenway.

The greenway corridor of hardwood swamps and bottomland forest along the St. Marks and Wakulla rivers provide wildlife habitat while functioning as conduits for many species of birds, the Florida Black Bear, and other animals. The water quality of the rivers can be maintained through the natural filtering capabilities of the hardwood swamps and bottomland forest, if a sufficiently wide greenway corridor is maintained and if Best Management Practices are followed in silviculture operations. The greenway can also function as a filter for residential stormwater runoff and septic tank nutrient rich leachates. By protecting the bottomland hardwood swamps and limiting the intensity of development in these wetlands, the impacts on the St. Marks river can be reduced. Also, by guiding



development away from the river, the hazards related to flooding on property and lives is also reduced.

The Town of St. Marks is the only incorporated municipality adjacent to the greenway and is the primary hub for recreation and commerce along the two rivers. The Town of St. Marks is a commercial port with the St. Marks River supporting an electric power generation facility, barge transportation and commercial fishing operations. The conservation of the St. Marks and Wakulla Rivers Greenway may provide the local Chambers of Commerce with a marketing tool for ecotourist-related businesses. The Governor-appointed Florida Greenways Commission is working to establish a statewide network of greenways linking communities and natural areas. Wakulla County is perfectly positioned for creating greenways linking the Apalachicola National Forest, the St. Marks National Wildlife Refuge, Wakulla Springs State Park and the Tallahassee to St. Marks State Historic Rail Trail. There is a tremendous potential for marketing this watershed and the surrounding region as an ecotourism destination because of the variety of opportunities available. The resource areas of the region and watershed combine to provide the critical mass of opportunities necessary to entice visitors to the communities in the watershed and in particular Wakulla County. The greenway can provide the framework to tie the watershed's resource areas together and provide a unifying theme for future partnerships.

The St. Marks and Wakulla rivers abound in history. Visitors along the Tallahassee -St. Marks Historic State Rail Trail often know very little about the history of the lands which they are riding through. Through the development of historical trails on the rivers and along the rail trail, the St. Marks and Wakulla Rivers Greenway could provide visitors another recreation outlet based on the history of past cultures and events. A significant

historical interpretation site currently exist at Fort San Marcos de Apalachee and the Natural Bridge Battlefield site on the St. Marks River.

Analysis of the land ownership data collect from the property appraisers offices of Jefferson, Leon and Wakulla counties indicates that much of the land within one mile of the rivers are in large, single ownerships . This information is important for determining which greenway development strategies may be appropriate for particular river segments. The following discussion on the proposed St. Marks and Wakulla Rivers Greenway provides a description of each river by river segments.

St. Marks River Portion of the Greenway

The River Swamp Section

Much of the upper portion of the St. Marks River north of Natural Bridge is owned and managed for silviculture by the St. Joseph Land and Development Corporation. A few areas in the extreme northern reaches of the watershed near Interstate 10 and around Natural Bridge have multiple owners and are used for agriculture, silviculture and residences. Much of the surrounding land is classified as hydric swamps or wetlands, and is considered important habitat by the Florida Game and Freshwater Fish Commission (see Figure 10 - Resource Assessment). This section of the greenway also filters stormwater run-off, serves as a buffer area for natural flooding, provides a sediment sink from erosion of adjacent agricultural lands, and the wetlands here provide nutrients to the

river ecosystem. The upper reach does not provide good opportunities for canoeing because much of the river is not navigable due to dense wetland vegetation and the fact that are few public access points along the upper reach.

Although all the previous mentioned attributes of the St. Marks and Wakulla rivers will benefit from greenways, the greatest benefit of creating a greenway along this portion of the river may be protection of the water quality of the entire watershed. Land development of all kinds has a disproportionate influence on downstream areas. In this area the river has less flow and is narrower, the upland disturbances tend to occur closer to the St. Marks River's smaller tributaries. Consequently, nutrient and sediment loads tend to be higher per acre along these smaller streams than downstream where the river becomes larger (Binford and Buchenau 1993). Proper stormwater management is therefore critical for this section. The ditches and swales that drain into the river function as conduits for sediments and nutrients. An effective stormwater management system can make the difference in river water quality.

The Natural Bridge Section

Between Natural Bridge to the Town of St. Marks, the river's ownership patterns become more fragmented. The riverfront is lined with homes along the west bank for about 2.5 miles below Natural Bridge. There are few scattered homes on the west side of the river south of Newport. Much of the land inbetween on the west bank appears to be in two ownerships and is managed for silviculture. The entire east bank of the river from Natural Bridge to St. Marks National Wildlife Refuge has only a few ownerships and is also managed for silviculture.

The Natural Bridge Section of the greenway functions as a filter and a conduit. Based on the land use and land cover and critical areas maps, the middle section of the greenway along the St. Marks River has the greatest potential for filtering or buffering the adjacent silviculture operations as well as the residential development located between Natural Bridge and Newport. There are few areas in this section with excellent habitat. The river swamps are relatively narrow and much of the adjacent uplands are pine plantations. This portion of the greenway provides opportunities for canoeing and boating. It also provides a natural corridor for animals to move between the Refuge and the swamps and uplands of the upper portion of the watershed.

Newport to St. Marks Section

South from Newport, the greenway is influenced by increasing urban development along the west bank in juxtaposition with the St. Marks National Wildlife Refuge on the east bank (see Figure 6). This section of the St. Marks River is deeper and wider due to channel dredging by the US Army Corps of Engineers for oil carrying barges. The barges serve the oil tank farms and the City of Tallahassee Power plant located along the rivers western bank in the town of St. Marks.

Much of the ecological benefits afforded by the greenway will accrue on the east side of the river which is bordered by the Aucilla Wildlife Management Area and the St. Marks National Wildlife Refuge. Much of the greenway corridor is intact along the west bank between Newport and the industrial complex at St. Marks, future residential

development in the area could ,however, degrade the greenway's ability to function as a natural filter, if stormwater runoff, noise, extensive land clearing, and visual intrusions are not managed properly (see Figures 6,and 10)

Wakulla River Portion of the greenway

The land along the Wakulla River is more fragmented by roads and residential development than it is along the St. Marks River (refer to Figure 5). The following discussion describes the three Wakulla River sections of the greenway - Wakulla Springs, Between the Bridges, and Lower Bridge to Apalachee Bay. Silviculture is the predominate use of the western bank. South of the US 98 Bridge the land is managed for silviculture and as a safety zone for Olin Corporation. The river flows through the St. Marks National Wildlife Refuge to the west and south of the port Town of St. Marks where it joins with the St. Marks River.

Wakulla Springs Section

The Wakulla Springs section of the greenway is delineated by the Wakulla Springs State Park above State Road 365 (see Figure 5 and Figure 7). The Wakulla Springs section provides habitat for animals, sources of native seeds for the river system, filters upland stormwater runoff and the surrounding swamps and functions as a sediment and nutrient sinks. The Wakulla Springs section provides visitors a place to swim, hike, tour on the spring fed river and view wildlife.

Between the Bridges Section - State Road 365 To U.S. 98

There are many homes on both banks of this section of the river. Homeowners have generally done a good job protecting vegetation on their properties and along the banks, but habitat along this portion has never the less been degraded by development. Canoeing, kayaking, and fishing are frequent activities in this section of the greenway, with many users accessing the river at the State Road 365 and U.S. Highway 98 bridges. The "Between the Bridges"section of the greenway functions primarily as a filter, but the corridor also likely provides a conduit for animals moving between the Wildlife Refuge, Wakulla Springs State Park, and the Apalachicola National Forest. Occasionally, visitors can see manatees feeding in the river's shallows.

Lower Bridge to Apalachee Bay Section

This section of the greenway starts below the US Highway 98 bridge and extends to Apalachee Bay. The west bank of the Wakulla River below the US 98 bridge is within the St. Marks National Wildlife Refuge. Much of the greenway on the west bank functions as habitat and a conduit where animals can move from the surrounding uplands to the river and to the Gulf of Mexico. Olin Manufacturing has maintained a forested buffer for their industrial plant operations along the east bank of the Wakulla River. This buffer follows the east bank from just south of the US 98 Bridge to the Shell Island Fish Camp in St. Marks. Olin's property along the river functions as habitat, a filter for stormwater and noise, and a conduit for animal movement. Olin has developed a small park on the water for the use of its employees.

CHAPTER 4

LOCAL AND STATE CONSERVATION PROGRAMS

Chapter 4 - Local and State Conservation Programs

Local Resource Conservation Programs

The Local Government Comprehensive Planning Act of 1985 required that all local governments in the state adopt a local comprehensive plan to chart the growth of the community for at least the next five years. The plans are to contain various mandatory and discretionary elements, each with goals, measurable objectives and policies that will guide all decisions on growth and development within the community. Within a year of adopting the plan, each government are to adopt or update land development regulations to implement and be consistent with the comprehensive plan. After the adoption of the plan and land development regulations, all local governments' development are required by law to be consistent with the adopted plan.

Each plan is required to contain a capital improvements element, intergovernmental coordination element, future land use element, traffic circulation element, sanitary sewage, solid waste, drainage, potable water and natural groundwater aquifer recharge element, conservation element, recreation and open space element, housing element, and for coastal counties including Wakulla and Jefferson counties, a coastal management element.

Each plan, adopted pursuant to the 1985 act, was submitted to the state Department of Community Affairs for review of its compliance with the State Comprehensive Plan, the appropriate Comprehensive Regional Policy Plan (now called the Strategic Regional Policy plan) and the rules of the department. All three counties within the St. Marks Basin have adopted their comprehensive plans and submitted them to the state. The City

Tallahassee-Leon County and Jefferson County's plans have been found in compliance. Wakulla County's plan has been found not in compliance and is continuing to undergo revision to meet the state requirements. The only incorporated municipality within the study area is the Town of St. Marks which has completed its plan and has been found to be in compliance.

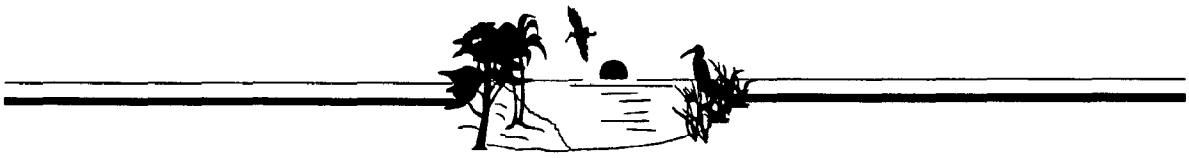
Review of the Local Government Comprehensive Plans

Each of the applicable local comprehensive plans is based on a general model provided by the Department of Community Affairs as part of its technical assistance program to local governments. For this reason, the basic format of each plan is similar, although they have been modified to deal with specific local conditions. The Wakulla and Jefferson County plans are fairly similar in scope and overall impact. The counties have about the same populations, but have very different geographical features. Jefferson County has adopted a series of land development regulations implementing its plan, while Wakulla has adopted only one applicable regulation, and none that are required by its comprehensive plan. This regulation is the groundwater protection ordinance for Wakulla Springs and the sinkholes to the north. Wakulla County has decided to wait until it completes its plan in a manner which would be approved by the state before it adopts its required land development regulations. The local comprehensive plan for the town of St. Marks reflects the community's desire for only a small amount of growth to its small population (approximately 350 people) or area (approximately 1000 acres).

The City of Tallahassee/Leon County plan is the only joint local government comprehensive plan in the state. Given its urban nature, this plan is much more detailed

in order to meet the demands of a large and growing population. As might be expected, Tallahassee-Leon County's land development regulations are (more elaborate and) complex than that of the adjoining local governments. The comprehensive plan is a mutual product of the City of Tallahassee and Leon County. This plan is administered by the Tallahassee -Leon County Planning Department.

All of the areas comprehensive plans contain general language about protecting wildlife and other natural resources, providing open space and recreational opportunities such as bike trails. The plans also contain other provisions that could serve as a base for the protection of the greenway once it is established. However, none of the plans have any specific greenways included in them. This omission is not surprising considering that the concept of greenways has gained acceptance as a conservation tool since most of the local comprehensive plans were initially adopted. The major difference between the plans as they relate to the potential for the designation and protection of greenways is that the Tallahassee/Leon County plan calls for local development and management of recreation areas for its citizens while the other local governments generally leave that to federal or state governments. Tallahassee and Leon County has greater fiscal resources to develop and manage recreational facilities than the rural governments which provide only limited local recreational facilities. In the past these rural governments have relied upon state or federal programs to provide such recreational facilities. Few local funds have been dedicated to maintain or developing new facilities. To overcome this hurdle, partnerships between governments and the private sector should be established or strengthened to further the development and management of facilities and infrastructure to complement the greenway.

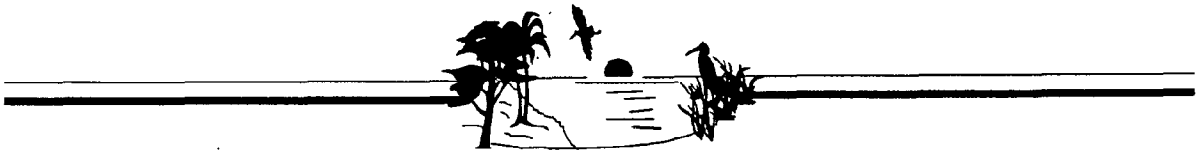


Town of St. Marks

The town of St. Marks is at the southern apex of the St. Marks watershed. Its local comprehensive plan generally reflects the need to protect the St. Marks and Wakulla rivers through its adoption of minimum vegetative buffers (25 feet). The Town of St. Marks has included no specific protection schemes. It recognizes the existence of the "Rail to Trails path" which runs the length of the town and has its southern terminus there. However, the Trail receives no special protection in its Land Use Element or Conservation Element, nor does the plan appear to recognize its economic and recreational value for the community and surrounding area. The Intergovernmental Coordination Element does not provide a process for solving disputes or working with adjacent governments in a comprehensive or continual basis.

Wakulla County

Since most of the St. Marks watershed falls within Wakulla County, the Wakulla County Comprehensive Plan will have the greatest impact on any greenway established within the basin. T he provisions of the county's plan recognize the public lands, rivers and other resources within the county, including Wakulla Springs State Park and the Tallahassee-St. Marks Historic Railroad State Trail, but fails to provide any special plan, program or requirement for their protection. This is left entirely to the land development regulations which have not yet been adopted, and to the plans of state and federal agencies.



The Capital Improvements Element of the Wakulla County comprehensive plan sets the level of service for hiking trails at one mile per 20,000 people and for bike paths at 1 mile for every 5,000 people. Both levels of service are currently being met by the Florida National Scenic Trail and St. Marks Rail Trail which pass through the county. The Conservation Element states that the county will cooperate with the state in finding appropriate lands to acquire for the rails-to-trails programs.

The protection of wetlands in Wakulla County is addressed in the Land Use and Conservation Elements as well as in most of the other elements. Thirty five foot development setbacks and 40 foot special interest zone has been established for wetlands and sinkholes. Seventy five foot non-disturbance zones of native vegetation are required along the rivers, except for certain water dependent uses for which small areas of disturbance are allowed. The 100-year floodplains and certain floodways also receive some protection from the impacts of building. Private lands in the floodways along the county's rivers are designated as Conservation on the Future Land Use Map. These areas are defined as those lands within the 25-year flood plain where waters flow in the general direction of the river channel.

The comprehensive plan requires that wildlife and their habitats are to be protected, but the method for doing so is left entirely to land development regulations yet to be adopted. Many of the elements of the plan, do however recognize the importance of wildlife protection. The Coastal Element recognizes of the importance of protecting Apalachee Bay for commercial and recreational fishing, but includes few specific protection mechanisms for coastal habitats. Furthermore, no mention is made of coastal recreational opportunities such as the legislatively designated Big Bend Historic Salt Water Paddling Trail along the coast.

Though the county has identified canoe trails on three of its rivers in its data and analysis, none are specifically mentioned in the plan. River protection of within the county has received some attention, however, protection and enhancement of water dependent uses are not mentioned in the comprehensive plan. The plan does not mention the Florida National Scenic Trail as a special part of the St. Marks Wildlife Refuge and Apalachicola National Forest nor the federal wilderness areas in the refuge or in the national forest. Wakulla County has begun investigating methods for designating and protecting canopy roads. Provisions for bicycling are included in the Traffic Circulation Element.

Wakulla County has adopted one land development regulation that restricts certain chemicals from being stored in the sinkhole zone from Wakulla Springs to the north in a narrow, one-mile wide area. Though Wakulla County has an Intergovernmental Coordination Element, it does not establish any processes for coordination or dispute resolution with its neighboring local governments.

JEFFERSON COUNTY

Jefferson County's local comprehensive plan is similar to that of Wakulla County. Though Jefferson County's plan recognizes the St. Marks River watershed, no special protection mechanisms exist for the St. Marks River as is provided for the Aucilla River. The Conservation land use category does not include any private lands, and is specifically limited to publicly owned lands. Most of the Jefferson County's lands within the watershed are managed for silviculture. These silvicultural uses are controlled through the state's Best Management Practices.

Jefferson County's comprehensive plan recognizes the importance of linear trails by considering the feasibility of establishing a county-wide plan for bikeways and horse riding paths. It also describes a canopy roads bicycle trail, the Wacissa River canoe trail and the Spanish and Bellamy historic trails. The plan directs the land development regulations to establish protection for various canopy roads within the county; however, these have not yet been adopted.

City of Tallahassee/Leon County

The Tallahassee/Leon County Comprehensive Plan is much more comprehensive and sophisticated than the other three plans covering the watershed. This plan contains similar basic provisions as those already discussed, but it recognizes the importance the parks and park planning, open space and recreation. Unfortunately, it too fails to recognize the concept of greenways or the use of linear connectors for recreation, non-motorized transportation and wildlife habitat protection. The Environmental Planning section of the Tallahassee-Leon County Planning Department is currently initiating a countywide greenway conservation plan.

Special provisions are included in the Transportation Element for the establishment of a Tallahassee - Leon Bicycle Plan and for the interconnection of travelways within the county for bicycle traffic. These are included to help alleviate auto congestion as opposed to the establishment of specific greenways or trails, but these provisions are a very important basis for future greenways development. The plan's Recreation Element does not adequately protect the Tallahassee-St. Marks Historic Railroad State Trail, but it does reference it in its Data and Analysis. The Transportation Element references the plan to extend the rail-trail north from the Capital Circle trailhead to Florida State University.

The extensive listing of parks and other public recreational facilities in the plan, as well as the expressed need for continued expansion of recreational opportunities, give a firm foundation for greenways development. These provisions place emphasis on local government action. This is very different from the other three plans, in which the more rural local governments are more than willing to allow state or federal management policies to dictate the location and type of recreational facilities.

The Tallahassee/Leon County Comprehensive plan also contains numerous provisions for wetlands, sinkhole and wildlife protection as well as the designation of open space. Various land development regulations contained in the Environmental Management Act implement these provisions.

Review of State Resource Protection Programs

The State of Florida has many programs which can assist with greenway conservation efforts. Many of the existing programs are geared to land acquisition and/or recreation facility development. Preservation 2000 is the most progressive land acquisition program in the country. Preservation 2000 has been the funding source for many of Florida's land acquisition programs since 1991. It provides nearly $300 million of annually bonded funds for many different conservation programs. The law directs approximately $30 million toward parks, trails, game and forest management, $30 million toward implementing growth management locally, $90 million toward protecting water resources, and $150 million toward conservation of wildlife habitat, forests and coasts. Preservation 2000 dollars assist in the funding of the following programs.

- Conservation and Recreation Lands Program (CARL)
- Florida Communities Trust Program
- Save Our Rivers
- Rails to Trails / Florida National Scenic Trail Acquisition Program
- Land Acquisition Trust Fund -Additions and Inholdings
- Game and Fresh Water Fish Commission Wildlife Habitat Trust Fund

Other state programs that may be useful for greenway conservation are the Surface Water Improvement Management (SWIM) Program, Historic Preservation Trust Fund, the Florida Recreational Development Assistance Program, special legislation and designations.

CARL Program

The CARL land acquisition program is administered by the Florida Department of Environmental Protection Like all other state land acquisition programs, CARL is a willing seller program, meaning the state only pursues acquisition of a piece of property if the property owner is willing to sell the property to the state. The CARL program purchases environmentally endangered lands for state parks, forests, wildlife management areas, beaches, and recreation areas. CARL projects typically are environmentally sensitive lands that have unique or rare habitats, endangered or threatened species, or unique geological features (Gluckman 1991). CARL is also used to:

- Conserve floodplain lands, marshes, and estuaries in order to protect and

enhance water quality and quantity, and wildlife not otherwise protected by local or state regulations; and

- ❖ Preservation of significant archaeological or historical sites (Gluckman 1991).

CARL projects tend to conserve the large natural systems and connecting components of the strategic greenway network.

Florida Communities Trust Program

The Department of Community Affairs administers the Florida Communities Trust which provides local governments assistance in implementing their local comprehensive plans. The trust administers a grant program which awards local governments funds for local land acquisition projects. Projects are selected if they further the objectives of growth management, natural resource conservation and outdoor recreation and demonstrate uniqueness. This program gives points for local greenway conservation projects.

Save our Rivers

The Save Our Rivers program is administered by each of the State's five water management districts. Each water management district is required to develop a five year plan laying out proposed land acquisitions for the district. Save Our River projects are selected based on water quality protection, natural communities protection, nonstructural flood control and protecting groundwater recharge areas. Save Our River projects often

provide public use benefits by providing additional park lands for local communities. Save Our Rivers is funded through the Water Management Lands Trust Fund, which is administered by the Florida Department of Environmental Protection. This program has conserved many river and wetland greenways throughout the state.

Land Acquisition Trust Fund (LATF)

The Land Acquisition Trust Fund was established in 1963 as a mechanism to fund acquisition of lands for parks and recreation areas. The portion of LATF under P 2000 targets private inholdings within parks and forests. All LATF acquisitions are concerned primarily with the recreation value of the land and their accessibility by the public (Gluckman 1991).

Game and Freshwater Fish Commission Wildlife Habitat Trust Fund

The Fish and Wildlife Habitat Trust Fund is a P 2000 funded program which seeks to purchase lands that are important to the conservation of fish and wildlife.

Rails to Trails/Florida National Scenic Trail Acquisition Program

This program was established to purchase abandoned railroad right-of-ways and protect sections of the Florida National Scenic Trail. The Rails to Trails Program is a

Preservation 2000 funded program that has focused on acquiring abandoned railroad rights of way which considers the current and future recreational need, costs sharing potential with other agencies, and the timing of the availability of the right of way (Gluckman 1991).

The Historic Preservation Trust Fund (HPTF)

The HPTF is a grant in aid program for individuals or governments that wish to identify and restore historic structures or sites. The program does not acquire property, but instead gives grants to fund planning and development or historic property acquisition by non-profit organizations and local governments. Projects are selected on criteria such as purpose, economic and other public benefit, and cost.

Surface Water Improvement and Management Program (SWIM)

The Surface Water Improvement and Management (SWIM) Program was created by the legislature in 1987 to protect and, where necessary, restore surface water bodies of state or regional importance. Each water management district is responsible for developing a SWIM programs involving three major phases: (1) development of a SWIM priority list of waterbodies of regional or statewide significance, (2) development of management plans for the waterbodies in priority order, and (3) implementation of the management plans (Snowden and Cairns 1993). The SWIM program has the ability to provide funding for extensive restoration of degraded waters. When combined with the district's Save Our River Program, the SWIM program provides an excellent tool for river conservation.

Other Programs

Several Florida rivers have been provided special legislation for their preservation including the Wekiva River in central Florida. In 1988, Governor Bob Martinez created the Wekiva River Task Force to evaluate existing regulatory, planning, and land acquisition programs of state, regional and local governments affecting the Wekiva River sub-basin. Two years later the Task Force submitted its report to the Governor recommending new legislation and changes in the current planning, management, and regulatory processes. The St. Johns River Water Management District and the East Central Florida Regional Planning Council strongly supported the legislative initiative. The special legislation originated from the lack of local government initiative to protect and to conserve the Wekiva River corridor from residential development expanding northward from the Orlando metropolitan area. The act which was passed by the legislature in 1989 established habitat protection zones, increased buffer widths and new requirements for development of regional impact's that fall within the Wekiva River Protection Zone.

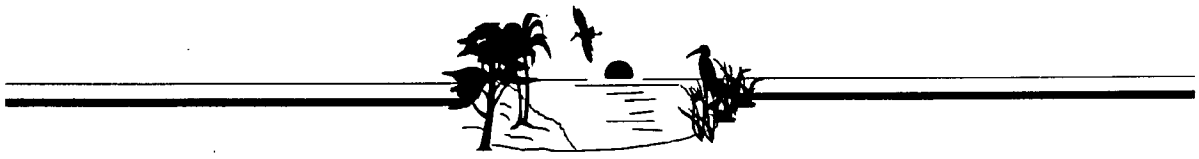
Fortunately, since the St. Marks and Wakulla rivers are not subject to as intense development threats as the Wekiva River, they probably do not warrant such special legislative protection. Another option is designation as a state or national wild and scenic river. Under the federal designation program, the Wakulla and St. Marks rivers would likely only qualify as a recreational river because of the adjacent development and the many bridges over the rivers. The Sopchoppy River is under consideration for federal wild and scenic designation, and the Myakka River in southern Florida has been designated a state wild and scenic river by the Legislature. The Florida Aquatic Preserve designation

program may also benefit conservation of the greenway by protecting water quality. The Florida State Rural Development Council within the Florida Department of Commerce is also available to assist local governments and citizens in developing economic opportunities related to conservation of the greenway.

The silvicultural operations which occur over a large portion of the watershed are controlled by the state Department of Agriculture and Consumer Affairs through its 1993 Best Management Practices. It provides for various protection mechanisms for logging along rivers, streams, lakes and sink holes. The functions of wetlands also receive some protection by the BMPs.

Summary of State Programs

These land acquisition programs, policies and laws enacted by the state and federal governments may assist in conserving St. Marks and Wakulla Rivers Greenway. In the greenway sections where there are large single land ownerships, fee- simple land acquisition and less-than-fee simple conservation provide excellent opportunities for greenway conservation if the owners are willing to participate. In the subdivided areas and areas where development has already occurred, the best alternatives for greenway conservation are proper land use planning and regulation, education about greenway stewardship, and innovative site designs and management.



CHAPTER 5

RECOMMENDATIONS FOR CONSERVING THE ST. MARKS & WAKULLA RIVERS GREENWAY

Chapter 5 - Recommendations For Conserving the St. Marks and Wakulla Rivers Greenway

In recognizing the corridors of St. Marks and Wakulla rivers as a greenway, the communities place a special value in maintaining the natural functions and aesthetic qualities of these unique areas. The citizens of Jefferson, Leon and Wakulla should act now if the greenway is to be conserved. Governments and citizens should work to form partnerships to conserve the greenway to take advantage of its conservation, recreation and economic benefits.

Development will continue to occur in the watershed affecting its water resources. Potential impacts include creating more impervious surfaces due to paving and building, dredge and fill activities, wetland draining, floodplain alterations, residential, industrial, and agriculture and silviculture activities. If development occurs without growth management and land use planning, these activities could result in increased habitat fragmentation, stormwater run-off, localized flooding and an overall decrease in surface water quality. Development and alteration of river floodplains can reduce the area for flood waters to dissipate. Development can reduce the floodplain area and increases stormwater run-off and as a result, flooding tends to become more frequent and severe. The increased flood height and magnitudes resulting from improper floodplain development may lead to increases in erosion and sediment deposition into the rivers (Wolfe et al. 1988). A greenway conservation effort focused on the St. Marks and Wakulla river can potentially minimize these negative impacts from development while furthering many conservation, recreation and community quality of life goals. Greenway planning is not intended to prevent future development, but rather to ensure that it occurs in a manner which minimizes impact to the resources.

The following recommendations provide suggestions for how to conserve and promote greenways in the St. Marks and Wakulla rivers watershed. These recommendations have been organized by the agency, group or individuals who may elect to take the lead in their implementation. These recommendations can be implemented thorough growth management, land conservation and management practices, partnerships, and through the actions of individuals and groups. The St. Marks and Wakulla Rivers Greenway Steering Committee is available to help decision makers by providing recommendations and public input concerning these recommendations and to refine how these recommendations can be implemented.

Recommendations for the Local Governments

Local governments within the St. Marks and Wakulla rivers watershed, with the exception of the City of Tallahassee and Leon County, have few if any financial resources to actively manage the greenway. These rural counties and the town of St. Marks will need financial assistance through grants and other sources to carry out remedial changes to their comprehensive plans and to implement greenway programs.

Lands owned by the state and federal governments should be integrated into community greenway conservation plans. These lands substantially benefit the local communities and could enhance both economic development and recreational opportunities if properly integrated into joint cooperative programs. The local governments should explore the recreational opportunities provided on these public lands and develop partnerships with their managers to attract tourists and their dollars to the watershed.

Now that the local governments have adopted comprehensive plans, it is important for each community to review opportunities for linking the state and federal lands within its boundaries. The recommendations suggested below can be very helpful in assisting the local governments with that endeavor. These public lands should be viewed as assets that can enhance the community efforts in economic and recreational opportunities. These lands should be considered a positive part of the process and integrated into the community's greenway conservation effort. One option pursuing an effective greenway conservation program in the St. Marks and Wakulla rivers watershed would be to the local comprehensive planning process.

Because greenways encompass many disciplines and objectives, the most effective way of establishing and protecting them is to create a planning process or entity that will include many facets. Greenways could be included in practically all elements of the comprehensive plan. The most efficient and effective method for the local governments to incorporate greenways is to amend their local comprehensive plans in a manner that builds upon the existing plans and refers to those the goals, objectives and policies that best address these issues but that would necessitate a wholesale revision of the existing plan.

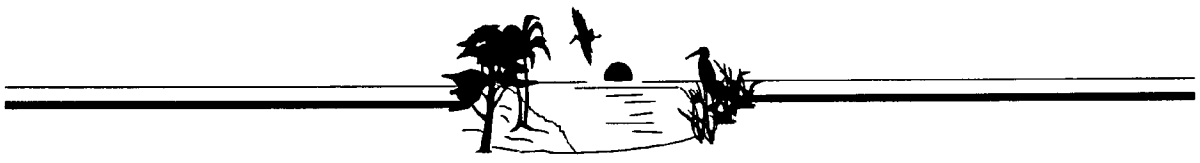
A local plan amendment is recommended because it can focus on the multiplicity of benefits of a greenway and can emphasize the importance of the greenway to the community as a whole. This plan amendment could also help emphasize the economic development and recreational benefits the community that can be realized if the community works with the other local governments, as well as state and federal conservation efforts. A plan amendment to the comprehensive plan could also give visibility and cohesiveness

to the greenway while maintaining the necessary flexibility for each local government.

Because there are a number of locations within the plans that are applicable to the greenway, a plan amendment could be located in any number of elements. However, one option would be to use the Intergovernmental Coordination Element (ICE) for the reasons suggested below.

First, the Environmental Lands Management Study Committee III (ELMS III) legislation in 1993 required that the ICE be substantially revised for all local governments. This means that the four governments in the basin will have to go through a thorough amendment review and adoption process prior to August 1, 1997. Including the greenway concept in the ICE at the time of its revision would have the least disruptive impact on the local planning process. In addition, the Evaluation and Appraisal Report (EAR) for each local government is due approximately the same time. To develop this report, local governments must review their plan for compliance, effectiveness and updating. This review process allows each local government to seek out the provisions that should be referred to or developed for incorporating greenways into the community.

Second, the watershed encompasses three counties and one municipality. Most, if not all, of the proposed greenway identified in this report either crosses governmental boundaries or would be substantially affected by the actions of other governments. No effective greenways management and protection plan can be established if the governments involved do not coordinate. Placing the plan amendment within the ICE would give the greatest support for intergovernmental cooperation. Placing the greenway



plan amendment in a substantive element may unnecessarily color the process for particular greenways and potentially restrict their broad application and use in the future.

Finally, the Governor-appointed Florida Greenways Commission is proposing that greenways be incorporated into local government planning processes through amendments to the local comprehensive plans. The greenway plan amendment proposed is consistent with the Commission's recommendation to weave the plan's goals, objectives, and policies so a greenway conservation thread is created throughout the plan.

The plan amendment would need to include the appropriate goals, objectives and policies that are best suited for the establishment, protection and management of greenways within and between each local government. It is not the intent of this report to set out specific goals, objectives and policies for local governments to adopt. However, the authors are willing to assist local governments' individual needs in developing goals, objectives, and policies at the appropriate time. The following are some general ideas:

GOALS

Each government should adopt broad goals that express the multi-faceted benefits of the greenway to the community. These can either be separate goals or a single overall goal. The goal should be broad enough to cover a variety of future needs and functions of the greenway, but narrow enough to have some meaning. One example could be:

- Develop a plan to conserve the St. Marks and Wakulla Rivers Greenway in to provide recreational opportunities, conserve natural resources and improves the quality of life within the community.

Objectives

The objectives should include the intended dates to implement the greenways plan or plan elements and the various types and general locations of various greenways. There should be an objective for each proposed greenway, for example:

- By 1998, the community will establish and conserve the St. Marks and Wakulla Rivers Greenway to provide recreational opportunities and protect the river's water quality as Outstanding Florida Waters.

Policies

Policies should include the methods that will be used to accomplish the objectives as well as how the plan will be financed. They should also include the processes for interaction with other governments and references other applicable comprehensive plan goals, objectives and polices. Policies under each objective could be similar but should reflect the timing, financing and purpose of each individual greenway project. For example:

- By 1997 the community will seek funds and conduct a study of the economic, recreation and environmental benefits of the St. Marks and Wakulla Rivers Greenway.

- By 1997 the community will appoint a St. Marks and Wakulla Rivers Greenway Advisory Committee composed of forestry interests, riverside property owners and residents, boaters, anglers, scientists and others who have expressed an interest in greenway development. This group will meet and make recommendations to the local governments for the adoption of appropriate greenway management and protection measures.

- By 1997 the community and the committee will establish procedures for developing their recommendations and management plans in coordination with adjacent local governments and the Northwest Florida Water Management District.

- By 1998 the community will conserve greenways by incorporating appropriate management and protective measures into its local planning processes, and the community will coordinate with adjacent local governments to incorporate complementary measures into their planning processes.

Other Recommendations for Local Governments

The following recommendations include suggestions for further developing and promoting greenway protection and management programs that individual local

governments may have already begun implementing. These recommendations are offered to all local governments in order to create complementary greenway conservation strategies along all greenway segments.

- Consider working with state agencies to develop incentives to promote retention of silvicultural land uses and adherence to Best Management Practices in the greenways corridor.

- Consider establishing watershed-wide planning partnerships to develop a general consensus on land use goals and to improve intergovernmental coordination between the counties and the incorporated areas to conserve the greenway.

- Consider developing plan for the greenways to be adopted by each local government. Use the St. Marks and Wakulla Rivers Greenway Steering Committee to assist with planning efforts, education and public input for the planning process.

- Consider linking the greenway to parks, forests, other local greenways, trails and habitat areas to other similar areas outside of the watershed.

- Consider coordinating with the Florida Greenways Commission in order to tie into its efforts to create a statewide network of greenways. Celebrate Florida's 150th birthday to designating the St. Marks and Wakulla Rivers Greenway as one of Florida's 150 greenways

- Consider keeping the greenway as intact as possible to facilitate wildlife movement and maintain viable populations of designated species.

- Consider limitations on clearing native vegetation in the greenway.

- Consider using this study's database and map series to initiate and maintain a local greenway database.

- Consider sponsoring workshops with local builders and developers to promote appropriate site planning, design and landscaping for residential, commercial and industrial development in the greenway.

- Consider protecting greenways by fee-simple and less-than-fee-simple land acquisition methods. This may include participating in multi-government land acquisition project, creating incentives to develop and protect the greenway through tax incentives and conservation easements.

- Consider using mitigation in regulatory programs for use in conserving the greenway.

- Consider working with the local school board and others to incorporate into local education programs the importance and relationships of conserving the greenway.

- Consider working with public land managers, historians and users in developing signs to aid interpretation of the greenway's historic and natural sites and to provide

continuity along the greenway. Consider adopting an architectural theme for public use facilities in the greenways.

- Consider incentives to encourage development of businesses especially in Wakulla County, to serve greenway users including those providing overnight accommodations, food, recreational equipment, guide services and other hospitality businesses,

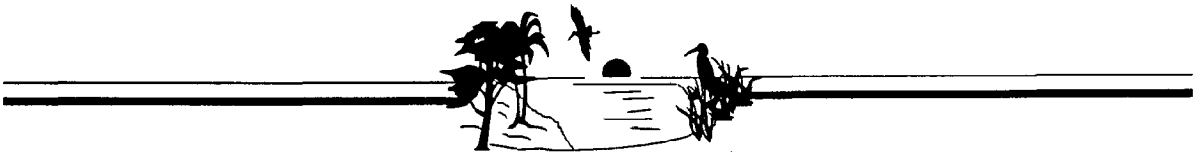
- Consider promoting the special natural and recreational features and historical areas of the watershed to attract ecotourists and benefit economic development.

- Consider participating in a proposed Apalachee Regional Ecotourism Development Council that markets the Apalachee Region as a destination for outdoor enthusiasts. Council members could include local chamber of commerce members, hospitality managers, camping/outfitting retailers, guide services and liveries, hunting and fishing organizations, and recreational user groups.

- Consider endorsing and co-sponsoring recreational and tourism publications such as maps and guidebooks.

- Consider investigating the need to establish a local government land acquisition program for conservation and recreation lands.

- Consider seeking state, federal and private funding to improve recreational facilities and acquire recreation and conservation lands within the greenway. Potential



sources could include the Florida Recreational Development Assistance Program and the Land and Water Conservation Fund which are administered by the Florida Department of Environmental Protection, and the Florida Communities Trust which is administered by the Florida Department of Community Affairs.

- Consider studying the need for developing a local stormwater management plan for the urban areas such as the Town of St. Marks to help protect greenway water quality.

- Consider forming alliances and partnerships such as the Apalachee Land Conservancy, the Trust for Public Land, The Nature Conservancy, 1000 Friends of Florida, Florida Audubon, HuManatee, St. Marks Trail Association, the Florida Trail Association, to promote and manage ecotourism use with private interests neighborhood and home-owner associations, local businesses and landowners, and the Chambers of Commerce.

- Consider seeking planning assistance from organizations such 1000 Friends of Florida, the Trust for Public Land, and the Rivers, Trails and Conservation Assistance Program of the National Park Service for conserving these greenways.

Recommendations for Regional, State and Federal Agencies

There are many opportunities for Federal, state and regional agencies to assist local governments and citizens conserve the St. Marks and Wakulla Rivers Greenway. These agencies could assist with land acquisition and facility development, land management, planning and other technical assistance. Land acquisition and recreational facility development by these agencies could complement existing public and private resources to strengthen the foundation for the greenway. These agencies ongoing management programs could continue to provide many of the services and facilities necessary to support public recreational use. Planning and technical assistance from the Department of Community Affairs, the Department of Environmental Protection and the National Park Service could complement a local government's efforts in greenway conservation planning. Although, this report does not assess the conservation or recreational value of particular parcels of land that could be acquired or otherwise conserved, specific portions of the watershed can be targeted for conservation.

- ❖ It is recommended that the Department of Environmental Protection and the Northwest Florida Water Management District evaluate the upper portion of the St. Marks River north of Natural Bridge for protection through acquisition under the Conservation and Recreation Lands (CARL) and the Save Our Rivers (SOR) programs. It is further recommended that the Department of Environmental Protection proceed with the proposed CARL projects in the Natural Bridge Area. The programs which operate under the philosophy of acquiring lands from willing sellers, and can acquire fee or less-than-fee interests in lands. If the

owner is not interested in any form of land acquisition, the agencies can instead enter into management agreements to conserve the lands environmental and recreational values.

- It is recommended that the east bank of the river from Natural Bridge to St. Marks National Wildlife Refuge be evaluated for conservation through the SOR or CARL programs or by the US Fish and Wildlife Service as an addition to the St. Marks National Wildlife Refuge. The eastern river bank is especially important as much of it is classified as critical habitat for fish and game by the Florida Game and Fresh Water Fish Commission. The eastern bank could form a natural green riparian link between the habitat of the upper watershed and that of the St. Marks National Wildlife Refuge surrounding the river's mouth.

- It is recommended that the silvicultural and other large undeveloped parcels that remain along the Wakulla River be evaluated for conservation through the CARL or SOR programs or as additions to the St. Marks National Wildlife Refuge. The lands provide important areas for habitats and could help protect the greenway linkage along the Wakulla River connecting the St. Marks National Wildlife Refuge with the Wakulla Springs State Park and the Apalachicola National Forest.

Other Recommendations

- The Northwest Florida Water Management District (NWFWMD) should initiate a Surface Water Improvement and Management Plan for the St. Marks and Wakulla rivers watershed.

- The Apalachee Regional Planning Council (ARPC) and NWFWMD should evaluate the need for establishing special river conservation strategies through special legislation or federal designation including a natural resource of regional significance.

- The NWFWMD should evaluate lands within the greenway for acquisition through the SOR program.

- The Department of Environmental Protection, Game and Freshwater Fish Commission, the Division of Forestry, the Department of State, and the Department of Community Affairs should evaluate lands within the greenway for conservation through all applicable land acquisition and recreational facility development programs.

- The Department of Commerce, Department of Environmental Protection, Department of Community Affairs and the Apalachee Regional Planning Council should provide technical assistance to local governments for greenway planning, management, promotion, and economic development.

- The Apalachee Regional Planning Council should establish and provide technical assistance to a proposed St. Marks and Wakulla Rivers Greenway Advisory Committee whose role would be to voluntarily coordinate activities Members should include local, regional, state and Federal governments, landowners, user groups, and other interested parties.

- The Department of Environmental Protection should develop informational materials for river frontage owners concerning landowner rights, public access limitations, and liability.

- State and Federal land managers should provide and maintain recreation user information and signs at their recreation access sites.

- The Florida Department of Environmental Protection should develop a public, hand-launch boat access near the St. Marks rise if lands appropriate for such access are acquired.

- The USDA Forest Service should consider working with the Florida Trail Association and the Department of Environmental Protection to acquire land so the Florida Trail can be moved from the US Highway 98 right-of-way making it eligible for designation as part of the Florida National Scenic Trail.

Recommendations for Individuals, Landowners, Private Interests and Users

The following recommendations include suggestions that individuals, landowners , private interest and users of the greenways may wish to voluntarily follow to conserve the St. Marks and Wakulla Rivers Greenway. Many individuals and landowners already show their stewardship for the greenways by voluntarily practicing many of these suggestions.

- Consider establishing a privately-owned and operated canoe livery which would provide access to the St. Marks River in the vicinity of the river rise. The livery could also provide canoe pick-up and shuttle service to and from the Town of St. Marks or the US 98 bridge.

- Since there is no regularly scheduled pick-up or shuttle available, consider initiating a regularly scheduled canoe pick-up and shuttle service for the Wakulla River operating from Wakulla Springs State Park and the Town of St. Marks.

- Homeowners along the greenway should consider the following: maintaining and using native vegetation; limiting the amount of vegetation removed near the river; accessing the river using boardwalks instead of paths; limiting the use of fertilizers and pesticides; and removing or not constructing bulkheads, seawalls and riprap for bank stabilization.

- Consider adopting sections of the rivers for cleanups or establishing river clean up days with the local school children, university students, neighborhood groups and social and service organizations.

- Consider starting a voluntary river watch program that would monitor water quality and provide laboratory testing facilities.

- Consider forming a voluntary river interpreter group to educate river users concerning river stewardship.

- Consider acting as a river steward through properly disposing of litter and waste, acting courteous to fellow river users, observing no-wake zones, and educating neighbors and users how to be stewards of the rivers.

Issues and Concerns Identified by the St. Marks and Wakulla Rivers Greenway Steering Committee

The Florida Greenways Program of 1000 Friends of Florida and the Northwest Florida Water Management District organized the St. Marks Greenway Steering Committee for the purposes of sharing information, receiving input on the project and gaining an understanding of the concerns of the citizens, local officials and landowners in the watershed. The following comments and concerns were provided by the members of the Steering Committee. It is recommended that these concerns and issues be considered as plans are developed for

conserving the St. Marks and Wakulla Rivers Greenways. These are not listed in any particular order of importance.

- Threats to the natural and cultural resources from existing and potential increases in recreational use. Prevent the greenway from being loved to death;
- Threats to manatees by collisions with boats;
- Establish signs and enforce no-wake zones ;
- Problems with litter from recreational uses, boaters and fishermen ;
- Sanitary and recreation access facilities should be maintained and improved to support increase tourism;
- Insufficient emergency management personnel and infrastructure to accommodate additional tourists;
- On site waste water treatment systems impacts on water quality;
- Potential restrictions on use of private property within the greenway;
- Oil and gas contamination of the river and its sediments;
- Management of the increased number of tourists;
- Lack of education about the proper use of the outdoors and boating etiquette;
- Lack of funds to upgrade and manage local park facilities;
- Potential impacts of boating on the rivers;
- Lack of good user or tourist information such as maps and guide books;
- Exotic vegetation both aquatic and terrestrial and impacts on the greenway;
- Protecting cultural and historic resources from vandalism;
- Improperly operating septic tanks along the rivers;

- Hunting deer and other game from boats along the greenway near homes, appropriate (compatible) uses of the rivers in general. Examine use of personal water craft, hunting and excessive boat speeds;
- Need regulatory signage and enforcement of laws. User education concerning regulations, responsibilities and use of the rivers, and
- Promote compatible uses, promote guide books and guide service.

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Technical Appendix

APPENDIX I - LAND USE AND LAND COVER ASSESSMENT

These maps provided an overview of land use within the watershed. Subbasins were delineated on 7.5 minute quadrangle topographic maps by the U.S. Geological Survey staff and digitized using ARC/INFO GIS software. Methods follow those described by Rains and Latham (1993). Satellite imagery was selected as the source for determining existing land use and land cover data. Existing land use and land cover were mapped using 1993 LANDSAT Thematic Mapper 30 meter resolution multispectral satellite imagery. Satellite image analysis was further refined using secondary data, including low altitude air photos and ground truthing. The classified satellite image raster files were converted to ARC/INFO vector files. Existing land use and land cover maps were geo-referenced to 7.5 minute quadrangles and merged to produce seamless basin-wide coverage.

Existing land use and land cover were classified using the Florida Land Use, Cover, and Forms Classification System (FLUCCS) developed by the Florida Department of Transportation (1985). Land use and vegetation cover were classified hierarchically, with each successive level including land information of increasing specificity. Level II (and level III where possible) of the FLUCCS hierarchy was used. Although FLUCCS categorizes land cover as either uplands or wetlands, many of the "upland" forests classes were found in low, wet areas and contained approximately equal portions of upland and wetland vegetation. For the purposes of this report the land use and land cover data has been aggregated. More detailed information is available on request.

Sites were selected for class verification base on accessibility. Much of the land within the basin either private property or not accessible by road. Accuracy of the existing land use and land cover classification was assessed by comparing predicted land use classes to observed classes, determined by air photo interpretation and/or field verification.

A minimum map accuracy of 85 percent, with a 90 percent to 95 percent confidence interval, is standard for most natural resource land use studies. It was beyond of the scope of the project to perform an accuracy assessment which could verify this standard. However, based on results the observed during the field verification performed and several similar studies completed by the District, it is anticipated these standards would be verified by further assessment.

Use of satellite imagery or aerial photography and maps for planning or regulatory purposes varies for regional, local, and site-specific endeavors. In this study, land use and land cover mapping was accomplished using 30 square meter satellite imagery with plus or minus one pixel resolution (30 square meters). While satellite imagery is an

exceptionally good source of regional land cover and land use data, it may be less satisfactory for urban areas and linear features due to resolution limitations. The resolution limits the ability to differentiate among some urban features using the imagery.

Existing land use maps identified many but not all streams in the St. Marks and Wakulla Rivers watershed. Linear features such as roads, streams, and stream-associated wetlands are particularly difficult to distinguish using satellite imagery classification. To register in satellite imagery, a linear feature must dominate the 30 square meter pixel. If a 15 meter wide stream and associated wetland vegetation bounded by 20 square meters of forest occurs at the pixel edge, only the forest may occur in the imagery due to its areal extent. Satellite imagery detects linear features in areas with high spectral contrast (such as a dirt road bounded by forest or bridge bounded by water), but tends to miss linear features with low spectral contrast (such as a stream bounded by a marsh). As a result, linear features often appear discontinuous when mapped using satellite imagery.

Recently, the water management districts (WMDs), FDEP and other regional and state agencies together purchased statewide Landsat satellite imagery. St. Johns, South Florida, Southwest Florida and Suwannee WMDs and local governments have also shared the cost of Photogrammetric mapping. The resulting purchases were made at a lower cost than previously budgeted by these agencies for only a portion of the state. Cost-sharing among state, regional and local agencies for land use and land cover mapping could result in better data and maps at a lower cost.

As part of the ongoing District Water Management Plan efforts, WMDs and FDEP agreed to use the 1985 FLUCCS as the primary classification system in order to ensure compatible land use and land cover data on a statewide basis. The districts and FDEP also agreed to recommend that DCA develop standards for the comprehensive plan future land use map to ensure greater consistency of base maps, scales, and cartographic standards. As land use and land cover data via satellite imagery become increasingly available, cost-sharing by state, regional and local agencies of land use change detection mapping and analysis would provide a good basis for monitoring comprehensive plan future land use implementation and estimating NPS loadings.

APPENDIX II - DESCRIPTION OF THE FLORIDA LAND USE, LAND COVER CLASSIFICATION SYSTEM (FLUCCS)

The Florida Land Use, Land Cover Classification System (FLUCCS) is a hierarchically-based configuration with four (4) different levels of categorization, each level containing information of increasing specificity. The following information has been acquired from the Florida Department of Transportation Land Use, Land Cover and Forms Classification System Manual - Procedure number 550-010-001-A (Department of Transportation, State Topographic Bureau, Thematic Mapping Section, 1985). This appendix describes the classification scheme used in conjunction with LANDSAT satellite imagery for the St. Marks and Wakulla Rivers watershed.

LEVEL 1

A LEVEL 1 classification contains broad classes of information which can be extracted from satellite imagery with minimal assistance from supplemental information. LEVEL 1 contains nine (9) categories of land use, vegetative cover and landform information, eight (8) of which were used for this project. This data is normally used for very large areas, typically at a scale of 1:1,000,000 or 1:500,000 (one-inch equals approximately 16 miles and eight miles, respectively). A LEVEL 1 classification may also be used for general planning purposes when more detailed data is not necessary.

LEVEL 2

The nature of the data in this class is more specific than the LEVEL 1 information. LEVEL 2 contains forty-two (42) sub-categories of land use, vegetation cover, and landform information of which twenty-eight (28) sub-categories of LEVEL 1 were used for St. Marks and Wakulla Rivers. This data is normally obtained from high altitude imagery (40,000 to 60,000 feet) and requires additional supplementary materials, such as other satellite imagery and topographic sheets. Mapping this level at a scale of 1:100,000 (one-inch equals 8,333 feet) is common practice. The St. Marks and Wakulla Rivers Project utilized 20 meter SPOT multispectral and ten meter SPOT panchromatic imagery, the combination of which enhanced the image to allow for a more accurate classification. As a supplemental data source, National High Altitude Photography (NHAP) was used to assist in the verification of the LEVEL 2 data.

LEVEL 3

This class of data is usually obtained at an altitude between 10,000 and 40,000 feet. LEVEL 3 data contains one-hundred and forty-seven (147) sub-categories of LEVEL 2, 11 of which were used for this project. It is typically mapped at a scale of 1:24,000 (one-inch equals 2,000 feet). The SPOT imagery was used to classify polygons to this level, and aerial photographs and topographic sheets were used to assist in the classification and verification process.

The following is an explanation of the major classes and sub-classes of the Florida Land Use, Land Cover and Forms (FLUCCS) Classification System. The St. Marks and Wakulla Rivers Project used a combination of LEVEL 2 and LEVEL 3 data to identify silviculture and wetlands sub-categories which allows for an accurate NPS assessment of the drainage basin.

100 - Urban and Built-Up

This class consists of areas of intensive use with much of the land occupied by man-made structures. This definition is for topographic and descriptive purposes, the very nature of which can give misleading information about why a polygon is classified the way it is classified. This category takes precedence over other categories when the criteria for more than one land use/land cover are met. For example, a polygon classed as a low density residential area (110) may also meet the same criteria for an Upland Hardwood forest.(420). Contained in this category are the following land uses: Residential, Commercial, Industrial, Extractive, Institutional, Recreation/Open land.

200 - Agriculture

Agricultural lands are those which are cultivated to produce food crops and livestock. Cropland/pastureland, Tree Crops (other than plantation monoculture), Feed Lots, Nurseries, Specialty Farms, and Rural Open Lands are sub-categories defined under Agriculture.

300 - Rangeland

The definition of Rangeland used in the FLUCCS is the same as that used by the departments of Agriculture and Interior. It describes the climax natural vegetation which includes Grassland, Shrub and Brushland, and Mixed Rangeland sub-categories. These areas become evident when larger-scale imagery is used and becomes significant to the project if used as wildlife forage areas.

400 - Upland Forests

This class is defined as an upland area with a tree canopy closure of greater than or equal to ten percent. Included in this category are pine, hardwood, and mixed forest and those areas where timber harvesting and subsequent regeneration are taking place. For a given forest stand to be classed as one particular species group, the polygon which contains the species must have a tree canopy comprised of 66 percent or more of the total canopy. Otherwise, the forest polygon will be classed as a mixed species. Classification of Upland Forests is most often supplemented through the use of aerial imagery.

500 - Water

The classification of a waterbody is dependent upon scale and resolution characteristics of the remote sensing imagery used for interpretation. In the case of the St. Marks and Wakulla Rivers Project, the 20 meter SPOT imagery was able to identify a water polygon of 2.5 acres or more or a linear water feature of at least 20 meters (approximately 66 feet). In some instances, a waterbody may be large enough to be identified as such or the waterbody may contain submerged or emergent vegetation. In this case, that waterbody will be identified under the Wetlands category. Streams and Waterways, Lakes, Reservoirs, Bays and Estuaries, Major Springs, and Slough Waters are included in this classification.

600 - Wetlands

Wetlands are those areas in which the surface of the land is at or near the water-table for most days of the year. These areas are able to support various species of aquatic and hydrophytic vegetation. Wetlands drained for any purpose belong to other land use categories, such as Silviculture or Residential land uses. If these areas are reestablished with wetlands vegetative cover, they are again classed as Wetlands. For more accurate classification supplements to imagery, the National Wetlands Inventory and low altitude aerial photography were used. Included in the Wetlands sub-class are Coniferous, Deciduous, and Mixed Forests, along with non-forested (emergent vegetation) and non-vegetated wetlands (tidal flats and shorelines).

700 - Barren Land

Barren Land has little or no vegetation and limited potential to support vegetative communities. Due to human activity, areas such as Agricultural, Extractive and Industrial land uses may be classed as Barren Land, therefore, these areas must be explored very closely through the use of supplementals such as aerial photographs and topographic sheets. Included in this category are the sub-categories of Beaches, Exposed Rock, and Disturbed Land.

800 - Transportation, Communication, and Utilities

Contained in this category are linear and point features such as highways, communication towers, and transmission lines. Satellite imagery can identify these features if minimal size of resolution (ten meters) is met. Therefore, certain secondary and

tertiary roads, small transmission lines, and point features, such as communication towers, will not be identified by the SPOT imagery. Supplementals such as topographic sheets must be used to identify these features.

APPENDIX III - NONPOINT SOURCE POLLUTION ASSESSMENT

Historically, most water quality problems in Florida were associated with point sources, including both domestic and industrial sources. Nonpoint sources have now been determined to account for the majority of the state's water quality problems. This change is due primarily to point source treatment improvements and increases in agriculture and urban developed land (Hand and Paulic 1992). NPS pollution has also been identified as the major factor affecting downstream water quality in about 80 percent of the urban areas targeted in a national survey conducted by the Council on Environmental Quality (1972).

NPS pollution is a major, largely uncontrolled, cause of surface water degradation throughout Florida (Livingston et al. 1989). NPS pollutants in northwest Florida include pesticides, animal wastes, nutrients, and sediments (Wolfe et al. 1988). In north Florida, the progression of natural ecosystems to silvicultural, agricultural, and urban uses has resulted in NPS pollution impacts including increased peak and total discharge, increased concentrations of dissolved solids, nitrates, and ammonia, and increased export rates of pollutants during storms (Livingston et al. 1989).Major contributors of these pollutants include agriculture, stormwater runoff, silviculture, landfills, and septic tanks (US EPA 1989). Land use type and intensity are strongly related to NPS concentrations.

Contaminants associated with NPS can be detrimental to water quality. Nutrients can have direct toxic effects or may stimulate algal growth. Pesticides and other contaminants can be dangerous to the aquatic ecosystem.

Sediments affect water ways by not only reducing their storage capacity but also by increasing the temperature of the water and providing increased opportunities for the growth of water consuming plants (Clark et al. 1985). Additional sediment impacts include damage to the biological health and integrity of the aquatic ecosystem along with a decrease in recreational and aesthetic values.

Stormwater runoff is a significant source of NPS pollution, having solids concentrations equal to or greater than untreated sanitary wastewater, and biological oxygen demand (BOD) values approximately equal to those of secondary effluent. Suspended sediment loads from streams draining urban areas are often an order of magnitude greater than those from nearby forested watersheds (Burton et al. 1977b). In addition, bacterial contamination of stormwater may be two to four orders of magnitude greater than concentrations considered safe for water contact (Field and Turkeltaub 1981).

Urbanization has been shown to fundamentally alter the hydrology of watersheds

(Anderson 1970). Increases in impervious surface areas result in substantially increased runoff (Simmons and Reynolds 1982, McElroy 1978). In addition, urbanization, with the associated land clearing and paving of pervious areas, has accelerated the problem of water quality deterioration throughout Florida. Stormwater and associated NPS pollution are responsible for:

1. 80-90 percent of the heavy metals deposited in Florida surface waters;
2. the majority of the sediment deposited in state waters; and 3.450 times the Total Suspended Solids flowing to receiving waters and nine times the BOD load when compared to loads from secondarily-treated wastewater effluent (Livingston et al. 1989).

Water quality changes due to urbanization also affect wildlife habitat. Jones and Clark (1987) indicated biological data were a better discriminator of urbanization stress on an ecological system than chemical parameters used in the same study.

METHODS

Basin boundaries, land use and land cover data, and selected loading rates were input and processed using the District ARC/INFO GIS. Land use and land cover acreage within the watershed were used in combination with selected loading rates to estimate total loadings by land use.

Satellite imagery and aerial photography were used to quantify existing land use and land cover in the St. Marks and Wakulla Rivers watershed. Potential NPS pollutant loading rates were estimated for existing land use and land cover classes. Due to staffing constraints, Local Comprehensive Plan Future Land Use Maps (FLUM) and future development scenarios were not included. Loading rate relationships were determined for four water quality parameters. Selected loadings were applied to each land use and land cover class and total loads were estimated. Specific areas with exceptionally high loadings were identified.

Land Use Categories and NPS Loading Rates

Existing land use and land cover within the St. Marks and Wakulla Rivers watershed were initially classified into more than 40 categories which included similar land use and land cover types. Due to the impracticality of developing and applying 39 individual loading rates, original categories were aggregated into 15 categories, based on similarities in loading characteristics (see Table A-3).

Previous NPS pollution studies were reviewed to corroborate loading rate estimates for water quality parameters and land use categories (Rains, et al. 1993). Loading rates for land use/cover categories were based on three studies, the Tampa Bay Watershed Study (Dames and Moore 1990), Florida Department of Environmental Regulation's Watershed Model Users Manual (Camp, Dresser and McKee 1991), and Reikerk (1983).

Loading rates for TN, TP, TSS, and BOD calculations were based on average annual rainfall (inches/acre/year), pollutant runoff coefficient (includes soil type, perviousness, etc.), pollutant runoff concentrations (milligrams/liter), by land use, and St. Marks and Wakulla Rivers mean annual rainfall (58 inches/year). Loading rates were reported in pounds per acre per year (lbs/acre/yr), and total loadings were reported in pounds/year (lbs/yr). Loading rates for TN, TP, BOD, and TSS were estimated for each land use category in developing composite loading rate relationships. Determining whether or not land uses met water quality standards was not within the scope of this study.

Loading rates from three studies (see Table A-4) were selected for use in the NPS assessment. All loading rate calculations were based on local rainfall data . Rainfall data for a five year period from the closest available rainfall stations, (Tallahassee and Wewahitchka) were used to identify an watershed average annual rainfall as 58 inches. (A summary of the 11 studies considered for their potential applicability to northwest Florida is provided in Appendix II).

TN and TP loading rates for four of the land use categories (institutional, transportation/utilities, tree plantations, and natural uplands), were derived from FDEP's Watershed Model Users Manual (Camp Dresser and McKee 1991). The manual provided event-mean concentrations based on percent impervious surface associated with land uses. TN and TP loading rates used to calculate loadings were determined by multiplying a weighted runoff coefficient by average annual rainfall (USGS gauging station) and event-mean concentrations from the Dames and Moore report (1990), FDEP documents, or estimated based on similar land use (see Table A-5).

Table A-3. FLUCCS codes for each existing land use and cover category in the St Marks and Wakulla Rivers watershed. Aggregated categories were based on existing land use categories and compatibility with future land use categories.

Existing FLUCCS Categories	Existing Aggregated Categories
Residential	Residential
Low density residential	Low density residential
Medium density residential	Medium density residential
High density residential	High density residential
Commercial/services	Commercial
Industrial	Industrial
Extractive	Extractive
Institutional	Institutional
Transportation	Transportation/utilities
Utilities	
Recreation	Recreation/open lands
Open lands (urban)	
Sand other than beaches	Spoil
Disturbed land/spoil areas	
Cropland/pasture	Cropland/pasture
Open lands (agriculture)	
Shrub/brushland	
Upland coniferous forest	Upland forests
Upland hardwood forest	
Upland mixed coniferous/hardwood forest	
Tree plantation	Silviculture
Forest regeneration	
Streams/waterways	Streams and lakes
Lakes	
Wetland hardwood forest	Wetlands
Gum swamps	
Titi swamps	
Inland ponds/sloughs	
Wetland mixed hardwood forest	
Cypress	
Wetland mixed coniferous forest	
Wetland mixed coniferous/hardwood forest	
Freshwater marshes	
Saltwater marshes	
Non-vegetated wetland	
Not applicable	Conservation

Table A - 4. Loading rates (lbs/acre/yr) for land use categories in the St Marks and Wakulla Rivers Watershed.

Land use	TN	TP	BOD	TSS
Urban				
Low density residential	5.76	0.74	16.12	55.90
Med density residential	10.10	1.63	37.22	100.03
High density residential	19.49	4.36	98.31	677.05
Commercial	21.10	3.14	130.90	894.67
Industrial	17.90	3.10	95.99	935.87
Institutional	5.55	0.71	73.51	475.29
Recreation/open	2.76	0.12	3.20	24.49
Non-urban				
Cropland/pasture	8.89	1.32	14.57	211.97
Upland forest	2.67	0.42	8.89	118.23
Silviculture	2.67	0.42	8.89	118.23
Lakes and streams	7.88	0.69	10.69	19.54
Wetlands	4.54	0.54	13.33	28.94
Spoil/barren	4.06	0.40	23.45	225.95
Extractive	5.37	0.68	43.70	427.41
Transportation/utilities	8.00	1.01	67.10	459.60

Table A-5. References on which loading rate estimates were based for the St Marks and Wakulla Rivers watershed.

Land cover category	TN	TP	BOD	TSS
Urban				
Low density residential	1	1	1	1
Commercial	1	1	1	1
Industrial	1	1	1	1
Institutional	1	1	1	1
Recreation/open	1	1	1	1
Non-urban				
Cropland/pasture	1	1	1	1
Upland forest	3	3	4	4
Silviculture	3	3	4	4
Lakes and streams	1	1	1	1
Wetlands	1	1	1	1
Spoil/barren	4	4	4	4
Extractive	1	1	1	1
Transportation/utilities	3	3	4	4

1. Dames and Moore
2. Riekerk
3. Watershed Management Model
4. NWFWMD: derived from 1-3

Silviculture TN and TP loading rates were based on those reported by Riekerk (1988). In a study of impacts of tree regeneration on water quality, Riekerk (1988) reported total Kjeldahl nitrogen (TKN) as the predominant nitrogen form in tree regeneration runoff. Because of the small nitrate differences in tree regeneration runoff due to variations in silvicultural techniques, TKN was used as an estimate of TN for this report.

The BOD and TSS loading rate estimates for the institutional category were calculated as the average of low density residential and commercial category rates. In order to be consistent with FLUCCS land use system, the transportation/utilities category was included in the NPS loadings tables. This category included only major road systems since loading rates for a given land use include roads and other infrastructure associated with the land use. Transportation/utilities category loading rates for BOD and TSS were calculated as the average of recreational/open and commercial category rates.

In the ECFRPC Areawide 208 Study, all waterbodies are assumed to have a runoff coefficient of 1.0 (Dames and Moore 1990). Many waterbodies, however, discharge only under extreme rain events, and some are landlocked with no discharge. Mean runoff value of 0.50 was selected, although varying characteristics made estimation of a representative runoff value for waterbodies difficult.

NPS Total Loadings

Urban. Total acreage for urban land use categories accounted for only 7 percent (13,439 acres) of the area in the St. Marks and Wakulla Rivers watershed (Table A-7, Figure 6 in the main body), while estimated TN, TP, and BOD loadings (Table A-7) for urban categories accounted for 11 percent and 14 percent of the total loadings in the watershed. Of the TN, TP, and BOD loadings associated with urban land uses, 8 percent was associated with low density residential and approximately 1-3 percent were due to commercial and industrial. Urban TSS loadings accounted for only 7 percent of the total TSS loadings in the watershed, and three percent were due to low density residential.

Lowest estimated TN loadings were less than one percent and ranged from 153 pounds per year for institutional (See Table A-7). TP loadings were less than 100 lbs/yr for the institutional, recreation and open urban land categories. Estimated BOD and TSS were also lowest, and similar, for recreation and open urban lands.

Non-urban. Non-urban categories accounted for 85 percent to 93 percent of total estimated loadings for each of the four NPS pollutants (see Table A-7). Non-urban categories accounted for 93 percent of the total acreage in the St. Marks and Wakulla Rivers watershed. Silviculture areas in the St. Marks and Wakulla Rivers watershed

Table A-7 Estimated Total Loadings in Pounds

LANDUSE CATEGORY	ACRES	%	NITRO LOADS	%	PHOS LOADS	%	BOD5 LOADS	%	SS LOADS	%
Residential	12,239.60	6.16%	70,508.00	8.97%	9,059.10	8.19%	197,344.30	8.94%	684,381.50	3.19%
Commercial	498.9	0.25%	10,526.20	1.34%	1,566.50	1.42%	65,302.50	2.96%	446,327.10	2.08%
Industrial	453.7	0.23%	8,120.80	1.03%	1,406.40	1.27%	43,548.30	1.97%	424,581.40	1.98%
Institutional	81	0.04%	449.3	0.06%	57.5	0.05%	5,950.60	0.27%	38,474.70	0.18%
Recreation	55.6	0.03%	153.4	0.02%	6.7	0.01%	177.9	0.01%	1,361.60	0.01%
Open Urban Land	110.6	0.06%	305.3	0.04%	13.3	0.01%	354	0.02%	2,709.10	0.01%
Urban Subtotal	13,439.30	6.76%	90,063.10	11.46%	12,109.40	10.95%	312,677.70	14.16%	1,597,835.30	7.45%
Agriculture	20,075.40	10.10%	178,470.10	22.71%	26,499.50	23.96%	292,498.20	13.25%	4,255,377.20	19.85%
Shrub and Brushland	7,340.40	3.69%	20,259.60	2.58%	880.9	0.80%	23,489.40	1.06%	179,767.20	0.84%
Xeric Oak	14,632.10	7.36%	39,067.80	4.97%	6,145.50	5.56%	130,079.80	5.89%	1,729,958.80	8.07%
Mesic Oak	7,703.50	3.88%	20,568.40	2.62%	3,235.50	2.93%	68,484.50	3.10%	910,789.30	4.25%
Hard/Conifer Mixed	26,747.60	13.46%	71,416.10	9.09%	11,233.90	10.16%	237,785.90	10.77%	3,162,365.90	14.75%
Upland Forest Subtota	49,083.30	24.70%	131,052.30	16.67%	20,615.00	18.64%	436,350.20	19.76%	5,803,114.10	27.07%
Silviculture	71,049.60	35.75%	189,702.40	24.14%	29,840.80	26.98%	631,631.00	28.61%	8,400,194.50	39.18%
Lakes	362.50	0.18%	2,856.10	0.36%	250.10	0.23%	3,874.70	0.18%	7,082.40	0.03%
Waterways	1,016.30	0.51%	8,007.90	1.02%	701.20	0.63%	10,863.60	0.49%	19,857.30	0.09%
Lakes/Waterways Subtotal	1,380.30	0.69%	10,857.40	1.38%	950.7	0.86%	14,729.10	0.67%	26,923.10	0.13%
Wetlands	36,033.00	18.13%	163,589.60	20.81%	19,457.80	17.59%	480,319.30	21.76%	1,042,793.70	4.86%
Beaches	20.2	0.01%	81.8	0.01%	8.1	0.01%	472.6	0.02%	4,553.50	0.02%
Spoil/Barren	166.4	0.08%	893.8	0.11%	113.2	0.10%	7,273.80	0.33%	71,141.50	0.33%
Transport./Utilities	125	0.06%	999.9	0.13%	126.2	0.11%	8,386.60	0.38%	57,443.90	0.27%
Nonurban Subtotal	185,273.50	93.24%	695,907.00	88.54%	98,492.10	89.05%	1,895,150.20	85.84%	19,841,308.70	92.55%
TOTAL	198,712.90	100%	785,970.10	100%	110,601.50	100%	2,207,827.80	100%	21,439,144.00	100%

accounted for 35 percent of the watershed and accounted for 39 percent (Table A-7) of the estimated total suspended solids associated with NPS pollutants in the St. Marks and Wakulla Rivers watershed. Estimated TN, TP, and BOD associated with silviculture accounted for 24 percent to 29 percent of the total estimated NPS loadings for these parameters. Natural upland forests made up 25 percent of the watershed acreage. Upland forest estimated TSS loadings were second to those of silviculture.

The agriculture category made up 10 percent of the total acreage in St. Marks and Wakulla Rivers watershed and contributed 13 percent to 24 percent of the total estimated TN, TP, and BOD loadings (Table A-7). Agriculture loadings estimated for TN (178,470 lbs/yr), TP (26,499 lbs/yr), and BOD (292,498 lbs/yr) were second to those for silviculture (Table A 7).

Estimated NPS loadings for wetlands were similar (TN = 163,590 lbs/yr; TP = 19,458 lbs/yr; BOD = 480,319 lbs/yr; TSS = 1,042,794 lbs/yr) when compared with values for silviculture and wetlands. Remaining land use categories contributed less than five percent of the total loadings for any of the four individual parameters (Table A-7) and were consistent with low acreage.

The transportation/utilities category included less than 1 percent of the acreage in the St. Marks and Wakulla Rivers watershed (Table A-7) and corresponded primarily to acreage of major roadways. Estimated loadings due to major roadways made up less than one percent of the total estimated loadings (see Table A-7).

Total existing urban land use acreage accounted for 7 percent of the area within the St. Marks and Wakulla Rivers watershed and estimated NPS urban loadings ranged from nine percent to 11 percent of total TN, TP, and BOD loadings, and 4 percent of the total TSS loadings. Potential per-acre water quality impacts appeared greatest for the commercial and industrial urban land use categories. Overall relationships among categories were consistent with other studies (Wanielista 1975, Hand and Paulic 1992) in which urban land use categories had higher TN, TP, TSS, and BOD values in surface water runoff when compared with values for non-urban runoff.

Although loading rates for non-urban categories were comparatively low on a per-acre basis, silviculture practices have tremendous potential water quality impacts in the St. Marks and Wakulla Rivers watershed due to the amount of acreage and existing land practices.

In contrast with urban land uses, silviculture included 36 percent of the watershed acreage and 39 percent of the total TSS loadings. These findings are consistent with reports in the literature regarding suspended solids runoff from silviculture areas.

Variation in nutrient and sediment loadings amounting to several orders of magnitude are common for forestry activities (Novotny et al. 1981), and TSS loadings from logging roads are significantly greater in the absence of appropriate BMPs (Lynch and Corbett 1990). Most sediment reaching waterways from these lands originate from construction of logging roads and from clearcuts which infringe upon natural drainage channels (Novotny 1981).

Water quality maintenance and control are normally achieved by implementing BMPs to reduce extreme pollution problems and promote rapid recovery. The BMPs are intended to control activities in stormflow source areas and promote acceptable road construction and soil conservation practices.

Results of this assessment reflect several areas of concern regarding NPS pollution in the St. Marks and Wakulla Rivers watershed. First, forestry and agriculture are responsible for the largest proportions of NPS pollution in the watershed. Secondly, while the literature indicates water quality impacts associated with these activities can be minimized through recommended BMPs, compliance with these practices is not easily enforced.

The impacts of silviculture and agriculture activities can be substantially reduced if recommended BMPs are comprehensively implemented and rigorously enforced. After evaluating the results of forest BMP surveys the Florida Department of Agriculture reported: "Of the 150 survey sites for 1991, 141 were found to be in compliance with silviculture BMPs which equates to 94 percent compliance",(Florida Department of Agriculture 1991) While many appropriate BMPs were implemented, most surveyed sites had several instances of non-compliance.

In an effort to clarify the use and interpretation of BMPs and make their application more consistent, Florida forestry BMPs have recently undergone substantial revision to increase water resource protection. If these changes are successful and compliance with revised BMPs is achieved, a reduction in NPS loadings from silviculture can be expected. The Division of Forestry is currently reassessing compliance and effectiveness of BMPs in an effort to more accurately reflect BMP compliance.

Three general options exist for abating NPS pollution from urban activity. The options involve prevention, treatment, and control measures, implemented as an integrated abatement approach (Wanielista 1975). In brief, prevention involves practices that are applied before problems arise; treatment involves complete or partial physical, chemical, and/or biological processes for minimizing impacts of stormwater; and control measures would involve reduction or control of pollution sources.

Ideally, limiting discharges from new developments to discharge that would

have occurred under natural, undeveloped conditions, in addition to maintaining water quality standards, should result in no increases in NPS pollution.

APPENDIX 4 - VIEW OF STORMWATER LOADING RATES FROM THE AVAILABLE LITERATURE

(1) Stormwater Loading Rates . December 1989. FDER Nonpoint Source Section staff.

Table A-8 was given to Northwest Wflorida Water Management District staff for comparison purposes. The numbers were not, however, documented. Values were included in the table matrix, but not considered for use in this study, since lack of documentation made it impossible to review data collection duration and watershed characteristics (homogeneity, etc.).

(2) Estimation of Loading Rate Parameters for the Tampa Bay Watershed 1989. Southwest Florida Water Management District [SWFWMD].

The literature search associated with this report was extensive, involving the review of approximately 100 reports and publications. Studies that were selected presented at least one year of data collection and measured only homogenous watershed areas. The report presents the results of a literature search and study of pollutant loading rates appropriate for selected parameters and land use types within the Tampa Bay watershed. The pollutant parameters selected for potential inclusion into a loading rate model were total nitrogen, total phosphorus, BOD, suspended solids, lead, zinc, total coliform, pesticides, and oil and grease. The selected land use types included low density residential (rural), single-family residential, multi-family residential, low density commercial, high density commercial, industrial, mining, agriculture, recreation/open space and water/wetlands.

Each selected study was evaluated for adequacy of the database with special attention given to factors such as length of study, number of runoff events monitored and monitoring methodology. The applicability of hydrologic and land use conditions were evaluated and data judged appropriate for the Tampa Bay area was used for the final estimation of pollutant loading rates.

The report included a summary table of mean annual loading rates for total nitrogen, total phosphorus, BOD, and suspended solids. Values were available for each of these parameters for each of the land use categories. Because of the vast amount of information researched for this report and the attention paid to data collection (sampling duration and watershed homogeneity), many of the final loading rate estimates for the St. Marks and Wakulla Rivers nonpoint assessment were obtained from this report.

(3) Nonpoint Source Waste Load Study for Indian River, Titusville, Florida. September

1985. Dyer, Riddle, Mills and Precourt, Inc.

The purpose of this study was to estimate the quantity of NPS pollutants in lbs/year entering the Indian River in Brevard County from 28 drainage basins. The following sources were used to determine the loading rates for total nitrogen, total phosphorus, BOD and suspended solids for each respective land use:

a) USGS studied a residential area in Broward County and multiplied the loads (lb/acre/in) by 56-inches of annual rainfall in Titusville;

b) East Central Florida Regional Planning Council (ECFRPC) provided loads (then multiplied loads using the rainfall ratio 56/50.5);

c) USGS studied commercial area in Broward County and multiplied loads (lb/acre/in) in by 56-inches of annual rainfall in Titusville;

d) ECFRPC "Middle St. Johns River Basin Study and Lake Tohopekaliga Agricultural Runoff Plan with correction to 56-inches of annual rainfall;

e) ECFRPC - Nonpoint Source Evaluation, Chapter 10, Table 10-2 with correction to 56-inches of annual rainfall.

The results of the calculations do not take into account the impact of the city's stormwater management and conservation ordinance. NPS data from developments constructed before and after the ordinance would be required to determine what impact the ordinance has on loading rates. Also included were the estimated loads to the Indian River for the proposed land use for the City of Titusville as a prediction of what can be expected if the future land use is carried to completion. This report was the source for the St. Marks and Wakulla Rivers watershed loading rate estimates for the land use categories cropland/pasture, forest natural upland, and transportation/utilities.

(4) Agriculture Nonpoint Source Element - State Water Quality Plan. June 1979. Florida Department of Environmental Regulation.

This report contained site-specific analyses of the five watersheds chosen from the top 20 ranked within the state based on their potential for water quality problems due to agricultural activities. In this publication total annual loadings for the five specific watershed areas were calculated from land use and areal loading rates. Also contained in the report were site-specific analyses for each watershed, methods used for determining the extent of water quality problems caused by agricultural activities and management practices for pollution control. The five watersheds included in the study were Escambia

River Basin (Canoe Creek), North St. Lucie Basin (Ten/Eleven Mile Creek), Upper Oklawaha River Basin (Yale-Griffin Canal), Middle Suwannee River Basin (Little River), and the Chipola River Basin (Spring Branch). For the Canoe Creek study, a cautionary note that stated the pollutant yields per-acre may not be accurate enough as they are based on literature values. It was also stated that a wide variability exists between the estimates and the actual loadings observed in the field. It was recommended that a receiving water analysis be performed in order to demonstrate that the loads were, in fact, producing sizable water quality problems.

(5) Nonpoint Source Effects. January 1976. M.P. Wanielista.

The results of a literature review on loading rates for BOD, suspended solids, nitrogen, and phosphorus for several land uses are included in this document. The average value is used to assess the potential quality problems resulting from NPS. It should be emphasized that studies from Florida only were used in determining the loading rates. As much data as possible, relative to local or regional conditions, should be used. Also, the loading rates are average values and are adjusted for an average rainfall quantity of 52 inches, which is the approximate average for the State of Florida. The range of the loading rates for suspended solids was wide, but expected because of variable erosion conditions. Additional research should be done on quantification of loading rates per unit area and time.

This report states that land use and precipitation are the two most important variables affecting NPS pollution. Assuming precipitation is of sufficient intensity, duration, and quantity, runoff and infiltration quantity and quality are dependent on ground cover, frequently expressed in terms of land use such as, urban, agricultural, pasture, forested (woodland) wetlands, etc. Each land use has certain permeable and impermeable characteristics that determine, to a great extent, the quantity of runoff, evapotranspiration, and groundwater infiltration. The type of land use is frequently equated to a runoff coefficient and used in predicting runoff. Rainfall and the type of land use are relatively easy variables to quantify in Florida. If large areas, such as major basin segments, are to be used, then the use of average conditions for rainfall and land use would produce data that are reasonable. After justifying the need for more accurate nonpoint data, a program to collect additional information is necessary. This information would include data in the general areas of topography, land management, water quality impacts, and meteorology.

General goals for the management of nonpoint source effects due to the land and water use modifications are presented below. These goals are the basis for the work presented in the report. The goals providing this basis include the following:

a) to minimize the deleterious effects of runoff and infiltration from land and

water alteration activities on receiving waters by:

-minimizing the alteration of natural drainage patterns and conditions;

-minimizing soil loss due to erosion;

-maximizing the use of the soil's infiltration and percolation capacity to reduce the unnatural loss of surface waters within the individual watersheds under development;

-maximizing the use of management practices to reduce the levels of contaminants in the waters to be discharged;

encouraging the gradual release of runoff and infiltration into the receiving bodies of water.

b) to encourage the development and implementation of all plans to be consistent with comprehensive regional water quality/quantity management plans;

c) to encourage information flow and to foster an understanding of the impact of NPS on water quality and to develop implemental solutions to these problems;

d) to keep abreast of developments in the state-of-the-art techniques of managing pollution from NPS.

(6) Water Quality Characteristics of Urban Runoff and Estimates of Annual Loads in the Tampa Bay, FL. 1984. M.A. Lopez and R.F. Giovannelli.

The purpose of this report was to describe the water quality characteristics of urban runoff in the Tampa Bay area and to provide a method for estimating loads of substances contained in runoff from urbanized watersheds under existing and future conditions. From 1975 to 1980, an urban runoff data collection program, including streamflow, climatic, physiographic, and water quality data, was established at nine watersheds ranging from beginning to advanced stages of urban development. Gaging stations were installed to monitor rainfall and runoff for each watershed. Physiographic features that consist of size, shape, and slope of the watershed, type of land use, degree of land use, area of impervious surfaces, type of storm drainage, soil types, and surface area of lakes or detention ponds were compiled from aerial photographs, US. Geological Survey topographic maps, planning agency data, and field observations.

Regression equations were developed for estimating loads of substances contained in runoff from ungaged urban watersheds in the Tampa Bay area. Equations were developed for BOD, COD, total nitrogen, total organic nitrogen, total phosphorus, and total lead. Use of the regression equations requires watershed-based rainfall. The stormwater loads were computed as the product of instantaneous values of discharge rates and concentrations of water quality constituents sampled. A time factor was included, converting the discharge to incremental volumes, and summed to get the total stormwater runoff volume. Some precautionary measures are required for valid use of the regression equations for computing runoff volumes and water quality constituent loads. They are recommended to be applied only to Tampa Bay urban watersheds. Since the equations are empirically derived, they are only applicable in instances where values of the independent variables fall within range of values used in their formulation.

The same daily rainfall data was used in computations of runoff and annual loads for all watersheds. The differences in the computed runoff from the various watersheds were due to variations in land use and watershed characteristics. The differences in runoff are reflected in the magnitude of the computed basin loads of the various parameters involved (runoff volume enters directly into load calculations).

Selected water quality constituents computed by the Tampa Bay area regression equations were compared with those computed by other methods for other parts of the country. The annual loads computed, using the Tampa Bay area regression equations and the Broward County land use load factors, are of the same order of magnitude. Another comparison was made in the application of the U.S. Environmental Protection Agency (USEPA) screening procedure (Heaney and others 1976) to land use data at the St. Louis Street drainage ditch site. As determined by use of the Tampa Bay regression equations, the annual load of nitrogen was about the same, BOD was about one-half the magnitude, and total phosphorus was about one order of magnitude greater than loads estimated by the screening process. The Tampa Bay regression equations, because of their empirical nature, presumably reflect the high natural phosphorus content of bay area streamflow and fallout from local phosphate processing plants.

(7) Boggy Creek Water Quality Management Study, Final Report. 1988.South Florida Water Management District and East Central Florida Regional Planning Council

This study used a land use/nonpoint source model to develop control strategies on a regional scale. Developed by Camp, Dresser and McKee (CDM) (1988), this model simulated total nitrogen and total phosphorus loadings from the existing relatively rural watershed and then predicted loadings in future scenarios where the watershed was presumed to be highly developed, where residential, commercial and industrial uses

predominate. The model was also run for low density future conditions. A range of BMP nutrient removal efficiencies and calibration coefficients that represent the extremes of the probable ranges for these coefficients was applied in the model. As part of the study, the South Florida Water Management District (SFWMD) developed a maximum assimilative capacity (MAC) model to be used to compare the maximum assimilative nutrient capacity of the receiving waters with the nutrient loadings modeled by CDM.

Three land use/growth scenarios were developed by the East Central Florida Regional Planning Council utilizing current data and future projections as supplied by local governments within the basin. These scenarios include the following:

1) Existing land uses in the basin were modeled (1984) which included certain phases of Developments of Regional Impact (DRIs) which were present, and any other pre-existing development;

2) " Low Intensity" scenario - Assumes a slower growth rate and includes all future development proposed within a DRI by the year 2000. This scenario also includes all future development associated with the DRIs proposed, but not necessarily within the DRI;

3) "High Intensity" scenario - Assumes an intensified development rate over that of the low intensity scenario concentrating primarily in the rural southern and eastern fringes of the basin with the inclusion of the proposed southern connector beltway around the City of Orlando, and the ensuing growth associated with it.

In both future growth scenarios (high and low), wet detention was utilized in the model as the minimally-acceptable method of stormwater management, since it meets existing SFWMD and DEP permitting criteria and is currently the most commonly employed stormwater management practice.

Data collection consisted of gathering the information necessary to run both water quality impact models (East Lake Toho MAC model and Land Use/Nonpoint Source model). Nutrient loadings were determined using data from a USGS-maintained daily stage/flow recorder located in the southern portion of the basin below the Boggy Creek swamp combined with data received from the SFWMD monthly water quality station located downstream from the recorder. Nitrogen and phosphorus values were utilized in the model calibration of current land use runoff loadings for the entire Boggy Creek basin. Rainfall values (daily) were measured from the NOAA rain-gage at the Orlando International Airport (the monthly cumulative values for the period 1981-1985 were used in the study). For runoff calculations, the USGS stages were converted to flow rates using

the rating curve.

Description of Boggy Creek Model

Maximum Assimilative Capacity (MAC) Model - SFWMD used this modified Vollenweider (1976) model (Federico et. al 1981) which was applied to East Lake Toho to derive a preliminary approximation of the maximum assimilative capacity for phosphorus (the limiting nutrient) within the lake. This was based on per-basin surface area loading appropriation. The basic concept of the MAC model was to determine whether East Lake Toho would maintain its current mesotrophic status or become degraded upon urbanization. The MAC model has been used with success by SFWMD for Lake Okeechobee. This model was calibrated utilizing data collected during a three-year period. For output, the model determines the current and critical loading rates from the East Lake Toho basins. The current loading rate refers to the existing phosphorus contributions and the critical loading rates which are derived from the model for each basin and compared with the actual measured loads generated to determine whether a particular basin is exceeding its critical phosphorus loading rate. If the critical phosphorus loading rate is being exceeded, it is then possible to calculate the load reduction which would be required to stay within the means of the maximum assimilative capacity of the system.

The Description of the Land Use/Nonpoint Source Model (CDM)

The intent of this study was to develop a model capable of determining NPS control strategies on a regional scale. A relatively simple spreadsheet model, previously developed by CDM, was employed using the LOTUS Symphony program (version 1.1) for an IBM compatible computer. Data used in the preparation of this model was provided by SFWMD and ECFRPC. This land use/nonpoint source model simulated total nitrogen (TN) and total phosphorus (TP) loadings resulting from the existing rural watershed and then predicted loadings in future scenarios where the watershed was presumed to be highly developed, where residential, commercial and industrial land uses predominated. TN and TP were the only parameters used in the model. The major inputs needed to calculate nutrient loads included nutrient load calibration coefficients (Fn and Fp), rainfall conditions, areal extent of land, and BMP nutrient removal efficiency factors (REFs). The REFs assume that properly managed stormwater systems using BMPs will reduce nitrogen loadings by 30 percent and phosphorus loadings by 50 percent (from a particular land use type). Event mean concentrations (EMCs), which are standardized concentrations of nitrogen and phosphorus expected from a particular land use type, are combined with total runoff and nutrient load calibration coefficients to generate nutrient loadings from the current and future scenarios. The EMCs used were previously employed in other central Florida area studies. The purpose of the calibration is to more accurately predict nutrient loadings for the three development scenarios by comparing measured loadings to

modelled loadings. The ratio of these is the nutrient loading calibration coefficient. Prior to model calibration, nutrient loadings were determined using the existing land use, and then re-running the model to predict future low and high intensity development scenarios. Output consisted of annual loadings for each land use type (pounds/acre/year) which impacts Boggy Creek and East Lake Toho. The model was run for the current, low density future, and high density future conditions with a range of BMP nutrient removal efficiencies and calibration coefficients that represent the extremes of the probable ranges for these coefficients. The predicted current and future nutrient loading rates in the land use/nonpoint source model were analyzed for sensitivity to changes in the BMP nutrient removal efficiencies and the nutrient loading calibration coefficients.

Several management alternatives were suggested for local governments to consider in an effort to reduce nutrient loadings to Boggy Creek and East Lake Toho:

1) The development and implementation of master stormwater management plans;
2) The establishment of regional stormwater systems;
3) The amendment of local government stormwater regulations to include stricter controls in certain land use types, the promotion of local land use controls such as land acquisition and the protection of the extensive Boggy Creek swamp.

(8) An Assessment of Urban Land Use/Stormwater Runoff Quality Relationships and Treatment Efficiencies of Selected Stormwater Management Systems. 1988.- South Florida Water Management District

This assessment was initiated to address two objectives relative to stormwater runoff and its treatment. The first objective was to assess reported stormwater runoff quality for differing land uses throughout the U.S., with a focus on data collected within the State of Florida. The second objective of this publication was to evaluate the data reported in the literature concerning the treatment efficiencies associated with the various stormwater management systems.

One conclusion of this report was that for selected constituents, runoff water quality varies with land use. The land use types that were evaluated and compared in this assessment included residential, commercial, light industrial, roadway, and mixed urban. Statistical differences between runoff water quality parameters and land use classification were evaluated by using the Duncan's multiple-range test. This study concluded that higher nutrient loads were generated by residential land uses than commercial, mixed urban, light industrial, or roadways. Metal contamination was more widespread from commercial and roadway projects than from residential, light industrial, or mixed urban

land uses. Residential and roadway areas demonstrated higher export potential for chemical oxygen demand. There were no discernible trends for suspended solids export as a function of land use. Urban highway projects generally had higher overall pollutant loadings than rural roadway projects. Limited data indicated that organic contamination in the form of polycyclic aromatic hydrocarbons were comparable for residential, commercial, and highway sites, although significantly higher levels were found at a heavy industrial site. For any monitoring program designed for a specific land use, this report recommended utilizing the above information when designing a sampling strategy.

(9) Generalized Watershed Loading Functions for Stream Flow Nutrients. June 1987. D. A. Haith and L. L. Shoemaker.

The Generalized Watershed Loading Functions Model (GWLF) is based on simple runoff, sediment, and ground water relationships combined with empirical chemical parameters. According to the authors, this model is unique in its ability to estimate monthly nutrient fluxes in streamflow without calibration. Validation studies in a large New York watershed indicated that the model possesses a high degree of predictive accuracy. Although better results could perhaps be obtained by utilizing more detailed chemical simulation models, such models have substantially greater data and computational requirements and must be calibrated from water quality sampling data.

The concluding remarks indicate that the GWLF model has several limitations. Peak monthly nutrient fluxes were potentially underestimated by as much as 22 percent. Since nutrient chemistry is not modelled explicitly, the model cannot be used to estimate the effectiveness of fertilizer management or urban stormwater storage and treatment. The model has only been validated for a largely rural watershed in which agricultural runoff and ground water discharge provided most of the nutrient load. Although the urban runoff component is based on a widely used model (STORM), model performance in more urban watersheds is uncertain.

10) Assessing Regional Nonpoint Source Problems with the Aid of a Watershed- Based Simulation Model. 1989. B.M. Evans, N.F. Parks, G.M. Baumer, G.W. Petersen.

In 1979, the Pennsylvania Bureau of Soil and Water Conservation (PABSWC) designated a number of large watersheds throughout the state as "high priority" watersheds for agricultural NPS pollution assessment. In recent years, many county conservation districts have conducted watershed assessments for the high priority areas. One of the primary goals of these assessments is to satisfy the requirements of the "first level screening" process outlined by PABSWC for securing additional funding through the Chesapeake Bay Program to implement Best Management Practices. To date, most of these assessments have been accomplished using an "indexing-type" methodology for

identifying critical areas within a watershed. With this approach, variables such as percentage of agricultural land in row crops, percentage of agricultural land in cover crops, animal density, average slope, mean soil erodibility, and drainage density are weighted and evaluated on the basis of their relative impact on NPS contribution within each watershed. While this cost-effective approach has considerable merit, some criticism has been directed toward it because it does not directly produce estimates of nitrogen, phosphorus, and sediment loadings within a certain area.

The intent of this demonstration project was to illustrate how a computerized simulation model could be used to enhance the results of watershed assessments performed in Pennsylvania. Particular emphasis was placed on how a GIS could be used to derive parameters required by the simulation model and display the resulting output. A recently developed model called Agricultural Nonpoint Source (AGNPS) (Young et al. 1985) was used to simulate erosion, sedimentation, and surface runoff processes within a watershed in central Pennsylvania.

The original scope of work planned for a detailed analysis of the simulation modelling results be performed. Specifically, the original plans called for the following:

1) A comparison of model results with results obtained from a previous watershed assessment;
2) An evaluation of predicted nutrient and sediment loadings against water quality sampling data;
3) A sensitivity analysis to determine the relative change in model output with respect to changes in model input.

NPS models may be categorized in numerous ways, but of interest in this study were programmable, mathematical models commonly referred to as numerical models. Numerical models can be further classified as being either empirical or physical process models. Empirical models are generally cause-and-effect models in which a mathematical expression transforms a set of input variables into a description of the output without trying to describe the process taking place. Regression models (Universal Soil Loss Equation related), and statistical time-series models, and several "indexing-type" models are good examples of empirical models. Empirical models are generally simpler and require less data than physical process models, so they are cost-effective to use. Unfortunately, they are difficult to improve, cannot normally be extended beyond the range of data used in their development, are easily misapplied, and can be misleading about cause and effect. Physical process models are more sophisticated than empirical models in the sense that they attempt to simulate the physical, chemical and/or biological processes that take place in a given natural system. Such models, however, require volumes of data and extensive research to test. NPS models such as Chemicals, Runoff, and Erosion from Agricultural

Management Systems Model (CREAMS) (Knisel 1980), Areal, Nonpoint Source Watershed Environmental Response Simulation Model (ANSWERS) (Beasley et al. 1980), and more recently, AGNPS (Young et al. 1985) are typical physical process models.

The AGNPS model was developed by the Minnesota Pollution Control Agency, the Minnesota Soil and Conservation Board, the U.S. Soil Conservation Service, and the U.S. Agricultural Research Service (Young et al. 1985). The AGNPS computer program actually contains two sub-models which are used to analyze both sediment and nutrient transport within a watershed. The two sub-models used are single-event based models intended to simulate sediment and nutrient transport from primarily agricultural watersheds. However, land use/cover conditions, in addition to cultivated land, are considered as well. Proceeding from the headwaters of the watershed to the outlet, the pollutants are routed in a step-wise fashion so the flow at any point may be examined. In using this program, a watershed is first sub-divided into square cells. The basic components of the model provide for the analysis of hydrology, erosion, and sediment transport, and nitrogen, phosphorus and chemical oxygen transport.

Data required for model execution is normally obtained through field data collection, maps (topographic and soils), and various technical publications, tables, and graphs. Input data can be classified into two categories: watershed data and cell data. Watershed data includes information pertaining to the entire watershed and to the storm event to be simulated. Cell data includes physical information describing each of the cells, as well as parameters based on the land practices within the cell.

Once the watershed segmentation step was completed, the data input file was established. Compilation of the various types of data and deriving the necessary input parameters to drive the model can be very time consuming, so instead of using this manual approach many of these computations were done with the aid of a GIS. This approach was believed to be less expensive and more accurate than manual data compilation methods.

As a result of the final AGNPS model runs, a detailed watershed summary was generated for the Bald Eagle watershed. The results include analyses for hydrology, with estimates for nitrogen, phosphorus, and chemical oxygen demand in concentration and mass units. Preliminary output includes watershed and cell areas, storm precipitation and erosivity, and estimated values at the watershed outlet for runoff volume, peak flow rate, and a detailed analysis of the sediment and nutrient yields. The detailed sediment analysis include area-weighted erosion rates for both uplands and channels, sediment delivery ratios, mean sediment concentrations, area-weighted yields, and net sediment yields. These values are given for each of the five particle classes, as well as the total. The detailed nutrient analyses include the nitrogen and phosphorus mass per unit area for

sediment-absorbed nutrients, the soluble N, P, and COD mass per unit area in runoff, and the N, P, and COD concentration in the runoff. Additional runoff, sediment, and nutrient analyses are given for each cell. Runoff analyses for each cell provide estimates of drainage area, runoff volume, percent of runoff volume entering the cell from above and peak runoff rate. Sediment analyses for each cell provide estimates of upland erosion rate, amount of sediment generated within the cell, the amount entering the cell from above, the sediment yield leaving the cell, and the percent deposition in the cell. The detailed nutrient analysis for each cell provides estimates of absorbed and soluble nutrients in mass per unit area and the concentration of these nutrients in the runoff.

To aid in the evaluation of AGNPS model output, a program called AGNPSOUT was developed. Output maps which can be generated with AGNPSOUT now include the following:

1) Runoff, including drainage area, volume, generation both above and within the cell and peak rate;

2) Sediment delivery, including cell erosion, generated above, generated within, yield, and deposition;

3) Nitrogen production, including sediment delivered (both within cell and at cell outlet), water soluble (both within cell and at cell outlet), total production (sediment plus water), and concentration;

4) Phosphorus production, including sediment delivered (both within cell and at cell outlet), water soluble (both within cell and at cell outlet), total production (sediment plus water), and concentration;

5) Chemical oxygen demand within cell, cell outlet, and concentration.

In summary, it was the intent of this demonstration project to illustrate how AGNPS could be used for watershed assessments performed in Pennsylvania. In this study, the relatively new watershed model (AGNPS) was used to simulate erosion, sedimentation, surface runoff and nutrient transport processes within the Bald Creek watershed. Particular emphasis was placed on showing how a GIS could be used to derive model input parameters and display the resulting output. Additional work to complete the project is to be done at a later date as the model needs to be tested and calibrated for use in Pennsylvania.

(11) Silviculture, Hydrology and Water Quality in the Lower Coastal Plain of the U.S.A. 1988. H. Riekerk.

The loading rates for the land use categories Tree Plantations and Forest Regeneration areas for the St. Marks and Wakulla Rivers nonpoint assessment were derived from the results associated with this study. The study was conducted from 1976-1985 for three artificial watersheds to study the effects of intensive pine flatbeds forest management practices. The study site was 40 km northeast of Gainesville, Florida, in the Bradford Forest which belonged to a timber company. Slash pine flatwood plots were harvested and regenerated with high and low levels of disturbance, and a 40-year-old forest was left undisturbed as a control. The low-disturbance watershed was cut manually, bucked, and removed leaving considerable slash. To minimize disturbance, the site was quickly regenerated by slash chopping, bedding, and machine planting. The high disturbance was machine harvested, followed by slash burning, windrowing, harrowing, bedding, and planting. Each site was monitored for hydrologic variability as well as water quality impacts due to the silvicultural practices for an eight-year time period. In order to complete the loading rate matrix, it was decided to use this data for the category Tree Plantations as well as Forest Regeneration Areas. The first three years of data from the high-disturbed experimental watershed was averaged for the Forested Regeneration Areas' loadings for nitrogen, phosphorus and suspended sediment. It was decided that during the first three years after a watershed had been disturbed to this degree, the area would closely approximate what has been defined by the "Florida Land Use, Cover and Forms Classification System" (FLUCCS) as a forest regeneration area (evidence of windrows and site preparation). The Tree Plantation loadings for nitrogen, phosphorus, and suspended sediment were taken from the entire eight-year period for the combination of high and low disturbed areas. This decision was based on the idea that tree plantation runoff loadings can correspond to the high/low disturbed areas when cut and prepped, but can also approximate Natural Upland Forests during the non-disturbed growth stages. BOD loadings were not found in any of the silviculture studies researched, so the loadings for Natural Upland Forests and Agriculture were utilized in order to complete the loading rate table.

The following is a summary of loading rates assembled. The loading estimates were obtained from the aforementioned studies.

Table 1. - Summary of Land Use Loading Studies

Low Density Residential

TN	TP	BOD	SS	REF #
		(lb/ac/yr)		
2.25	0.34	6.86	27.50	(2)
1.50	0.26	4.70	28.00	(3)
14.27	7.60	48.89	902.26	(1)
4.43	0.47	10.80		(6)
5.09	0.79	(7)		

Multi-Family Residential

7.54	1.93	42.10	206.00	(2)
6.60	2.00	32.10	344.10	(3)
17.26	9.01	62.94	1081.40	(1)
5.88	0.87	(7)		

Commercial

12.03	2.10	69.65	474.50	(2)
11.30	1.10	63.00	647.00	(3)
10.95	5.13	47.89	725.18	(1)
5.34	3.12	44.52	300.93	(5)
5.45	0.51	(7)		
8.00	2.00	53.90	586.50	(4)

Highway

13.60	3.00	87.40	980.90	(3)
10.29	6.06	91.53	1508.95	(1)
4.50	0.36	(7)		
8.00	2.00	53.9	586.50	(4)

Industrial

8.56	3.70	46.80	696.00	(2)
11.30	1.10	63.00	647.00	(3)
12.02	8.43	47.21	1385.25	(1)
4.86	0.46	(7)		

Table 1. - Continued Summary of Land Use Loading Studies

Low Density Residential

TN	TP	BOD	SS	REF #
		(lb/ac/yr)		
		Open Lands		
1.31	0.16	2.48	23.70	(2)
2.32	0.21	3.70	29.12	(1)
2.55	0.32	(7)		
1.50	0.10	1.60	12.00	(4)
2.60	0.11	7.40	15.10	(4)
		Wetlands		
3.30	0.15	6.70	16.30	(4)
4.52	0.67	7.05	8.60	(2)
5.40	0.22	15.40	32.30	(3)
4.98	0.88	16.13	33.77	(1)
4.90	0.20	13.90	24.30	(4)
		Pasture		
7.20	1.30	16.20	434.40	(3)
4.70	0.27	10.00	750.00	(4)
7.54	4.60	46.02	1223.28	(1)
4.72	0.26	9.79	747.89	(5)
2.26	0.26	(7)		
11.00	0.50	14.60	393.00	(4)
5.60	1.00	15.10	391.70	(4)
		Agriculture		
4.49	0.88	4.10	18.20	(2)
4.40	0.22	16.20	27.80	(3)
23.00	0.94	16.00	3747.00	(4)
23.15	0.93	16.03	1997.03	(5)
8.30	1.86	(6)		
34.60	2.11	16.06	2721.00	(4)
		Woodland		
2.30	0.10	2.60	27.80	(3)
2.76	0.90	4.45	87.25	(5)
3.30	0.15	6.70	16.30	(4)
2.80	0.09	4.50	87.00	(4)

Appendix V - St Marks and Wakulla Rivers Greenway Steering Committee

The Florida Greenways Program of 1000 Friends of Florida and the Conservation Fund and the Northwest Florida Water Management District established the St. Marks Greenway and Wakulla Rivers Greenway Steering Committee. Citizens and planning professionals were invited to participate. The steering committees were held in public at the Town of St. Marks Town Hall. Members of the steering committee were asked to provide feedback and comments on the report. The following information includes, the steering committee's charge, agendas from each meeting and a summery of each meeting held, refer to the acknowledgements for the participating members.

Organization

The St. Marks Greenway Steering Committee is a coalition of private, public, regulatory, environmental, historical and recreational interests that have come together to develop a consensus regarding the creation and preservation of the natural, recreational and cultural resources, and ecosystem connections along the St. Marks and Wakulla rivers. The Florida Greenway Program of 1000 Friends of Florida and the Northwest Florida Water Management District will initially organize the committee in June of 1994 to receive input on a greenways resource assessment for these two rivers. Staff from Leon and Wakulla county's planning departments have expressed interest in maintaining the committee to work with issues and concerns in developing greenway conservation policies identified in the greenway assessment. While the Florida Greenways Program's role and the District's role may be diminished once the greenway resource assessment is complete, they are interested in seeing the plan implemented and may be able to assist with the committees efforts from time to time.

Membership on the Steering Committee is open to all and it does not constitute a public body with official standing, but it will conduct its business in a manner consistent with the public interest and advanced notice of all meetings will be provided. Support personnel will develop an agenda for each meeting and provide a copy to all committee members. The Steering Committee will conduct its business in an open, cooperative and consensus building manner. It will be the Steering Committees' policy to make decisions through a consensus whenever possible rather than through majority voting. Active participation by all steering committee members is urged. In the event any member may not be able to attend a meeting, please send a designee. The Steering Committee will continue to meet at the Town of St. Marks until further notice or if the committee decides to meet at another location in the watershed.

Work Products

The Steering Committee will be provided a draft greenway assessment on August 26, 1994 and will be asked to review a the draft greenway resource assessment and provide comments and feedback regarding the draft no later than Friday, September 9, 1994. Florida Greenways will address the issues brought up by the committee members in the final draft of the greenways resource assessment by September 15, 1994. The Committee may be asked to meet in the future on behalf of the counties or Northwest Florida Water Management for comments and public input on their respective St. Marks and Wakulla river greenway planning projects.

The Vision

The vision for the St. Marks and Wakulla Greenway is to conserve the green river corridors of the St. Marks and Wakulla rivers. The "greenway" is intended to become the focal point for wildlife and humanity in the watershed and thus the need to do more in terms of education and conservation. The greenway will provide for wildlife protection and movement, water quality protection, and provide a combination of land and water related recreation opportunities for citizens and visitors of Jefferson, Leon and Wakulla counties.

The Mission

The mission of the St. Marks and Wakulla Rivers Greenway Steering Committee is to assist in formulating recommendations for conserving the greenway along the St. Marks and Wakulla rivers, assist in developing community awareness of the greenway within the community, and facilitate in assisting the counties' greenway action plans.

Goals

- Conserve linear corridors of green open space linking the communities of Leon and Wakulla counties. Identify issues, interest, and opportunities concerning the establishment of the greenway system within the watershed, and assist in finding workable solutions towards greenway development.

- Assist local planning agencies with fostering intergovernmental dialogue by assisting the implementing agencies in providing comments and questions as the plan is implemented. Also, provide support for the greenway by helping public officials become aware of the importance of the St. Marks Greenway.

- Encourage sustainable land uses within the basin by conserving open space, habitats, compatible land uses within the watershed by exploring alternatives for planning, designing, permitting, construction, monitoring and management of the proposed greenway.

- To explore economic development opportunities from the establishment of the greenway through ecotourism development.

St. Marks River Greenway Steering Committee

An open Discussion on opportunities to develop greenways on the St. Marks and Wakulla Rivers

June 15, 1994

Agenda

10:30 a.m Introduction - .

Introductions, Kent Wimmer, 1000 Friends of Florida
Project Overview, Tyler Macmillan, Northwest Florida Water Management District

Your Vision for the greenway in the St. Marks and Wakulla Rivers Watershed - 11:00 a.m.

An open discussion of opportunities and issues by steering committee members surrounding the greenway concept

Questions for Discussion:

What should the boundary be for the greenway?
What should we name the greenway?
What opportunities exist for a natural and restored greenway?
What should be the role of government in planning and managing the greenway?
What should the role be of private industry, landowners and citizen organizations in planning and managing the greenway?
What are the disadvantages that you perceive in designating the rivers as greenways? What are the advantages of greenways?
What potential problems do we face in planning and managing the greenway and what can be done to overcome those problems?

11:35 a.m. Wrap-up -, Kent Wimmer

Where do we go from here?
What can each of us do?

SUMMARY OF THE JUNE 15 ST. MARKS GREENWAY STEERING COMMITTEE

Meeting opened with introductions by Kent Wimmer and Bob Williams of the Florida Greenways Program of 1000 Friends of Florida and, Tyler Macmillan of the Northwest Florida Water Management District. Kent and Tyler provided the project description and goals for the steering committee. Information packets were handed out concerning the project's boundaries, time frame and scope of work.

General concerns, comments and issues

One focus of the project is examining nonpoint source pollution of the St. Marks and Wakulla rivers and possible mitigation strategies for nonpoint pollution. Many positive and insightful remarks were made regarding this issue including:

More public amnesty days so citizens of Jefferson, Leon and Wakulla counties could dispose of household toxic and hazardous waste,

More public awareness on the use of lawn and garden fertilizers along the rivers

More public awareness of the precautions the oil industry is taking in St. Marks to prevent and reduce the hazards associated with oils spills and tank leakages.

The role of the steering committee was discussed. The steering committee requested 1000 Friends draft a vision statement and charge for the steering committee. Some members expressed interest in helping with the project.

Other issues discussed

The number and speed of the power boats traveling the rivers was discussed in relation to canoeists and manatees. Prop guards and other technological devices to reduce the impacts on the river bottom and manatees. Some healthy debate was engaged in over this issue. Private property liabilities were discussed by several river front land owners. It is proposed that ecotourism be developed in the watershed as a means of improving the economic conditions while maintaining the resources. Members discussed problems associated with more users on the rivers.

Liability of property owners letting the public use the river banks for day use activities.

Introduction of exotic plants to the St. Marks and Wakulla Rivers

Concern about illegal takings and defacing historic and archaeological sites

Litter, noise and other potential issues associated with increased use

The need for more public education about proper etiquette for using recreation lands and waters

Taxes and recreational use fees were discussed by committee members. Wakulla County's emergency response agencies may not be able to handle more tourists. It was mentioned if more emergency services are needed, then the citizens of Wakulla County should not have to bear the entire cost of it. Other recreational issues include:

a voluntary boat launch fee at county and city public boat ramps collected for public education and facilities improvements including;

methods of enforcing a voluntary use fee at the public boat ramps

joint marketing efforts by Jefferson, Leon and Wakulla counties to bring more tourist to the area as a destination for ecotourism activities.

Regulate and disperse use so as not to love the resource to death

Develop a historical trail with historical accounts placed on signs depicting the historical significance of the area.

St. Marks River Greenways Steering Committee

A forum to discuss opportunities to conserve greenways on the St. Marks and Wakulla rivers

July 22, 1994

Agenda

10:00 a.m. Welcome

- Introductions, project status, and review of vision and mission statements - Kent Wimmer, The Florida Greenways Program of 1000 Friends of Florida
- Presentation of Draft Land Use and Resource Feature Maps - Tyler Macmillan, NWFWMD

Your vision for the greenway in the St. Marks and Wakulla Rivers

❖ *Local and Regional Governments and Organizations* ❖

11:00 a.m. An open discussion of Greenways opportunities and issues by the steering committee

Possible questions for discussion:

- What should the boundary be for the greenway?
- What should we name the greenway?
- What opportunities exist for a natural and restored greenway?
- What should be the role of government in planning and managing the greenway?
- What should be the role of private industry, landowners and citizen organizations in planning and managing the greenway?
- What are the disadvantages that you perceive of designating the rivers as a greenway? What are the advantages of greenways?
- What potential problems do we face in planning and managing the greenway and what can be done to overcome those problems?

11:45 Wrap-up - Kent Wimmer

- Where do we go from here?
- What can each of us do?

12:00 p.m. - Adjourn

The St. Marks Greenway Steering Committee
Meeting Notes for July 22, 1994

Kent Wimmer of the Florida Greenways Program opened the meeting at 10:15 a.m. at St. Marks City Hall. Wimmer discussed the project's status and briefly reviewed the discussion of the last meeting on June !5. Tyler Macmillan of the Northwest Florida Water Management District provided a review of the maps. The maps displayed included the natural, recreational, and cultural resources map, the watershed - project boundary map, the land use - land cover map and the critical habitat map produced by the Florida Game and Fresh Water Fish Commission.

The maps presentation lead into a Steering Committee discussion of the sources used to develop the Critical habitat map. Macmillan explained that the map used Florida Natural Areas Inventory (FNAI) data combined with satellite land cover data to map areas of habitat that could support various indicator species. The information from the FNAI is a species occurrence database of all endangered, threatened and state critical concern species of plants and animals. The Florida Natural Areas Inventory is a source for the map. FNAI is a joint venture between the Nature Conservancy and the Florida Department of Natural Resources. The Game and Fish maps may not always be based on actual sightings and they do not readily take existing land uses into account when determining critical habitat.

The District's land use - land cover maps generated some discussion regarding the accuracy of the data. The satellite imagery indicated that a few areas on the map were clear cut/shrub and brush lands. Most of these areas are found near the St. Marks River and reflect recent silviculture harvest. Luann Rains clarified the issue by describing the limitations of the satellite and the computers. The satellite has a difficult time distinguishing between three foot trees/brush and 15 foot trees. They produce a similar reflectance and this problem is magnified when the area has recently been timbered and is adjacent to a mature forest. The District indicated that they would welcome comments and corrections regarding the land use and land cover maps provided that they could be mapped on USGS 7.5 minute quadrangle maps. The Steering Committee also indicated it wanted the District and the Florida Greenways Program to identify in the report the limitations of the Hot Spots map.

The Plan/Report was also briefly discussed. The Florida Greenways Program talked about what is anticipated to be the report including proposed future land uses, comprehensive plan reviews, ecotourism/economic benefits and functions of greenways. The District said that this plan/report will provide a point of departure for the initiation of a Surface Water Improvement Management (SWIM) program. The SWIM program will allow the District to conduct water quality analyses, biological assessments, and

hydrological assessments on the St. Marks and Wakulla rivers. Macmillan indicated that the St. Marks River is next priority SWIM project for the District and the St. Marks SWIM plan could be initiated in the next year. Macmillan indicated that the SWIM plan would considerably more detailed in its water quality collection and research than this greenways conservation project. The District would like to use this Steering Committee to assist in gathering public comments and concerns during the SWIM project.

Several issues and concerns were brought up by Committee members. Ecotourism was discussed. Cynthia Rusling brought up by that an additional canoe/paddle boat livery may be opening up in Newport. The additional canoes/paddle boats may have some conflicts with power boaters. No wake zones and public education about the use of the river and proper boating courtesy were mentioned, as were the impacts of additional boaters on the river. It was suggested having River Rangers who patrol the river and educate the users about river recreation ethics could be one solution to the problem.

During the course of the meeting the term greenway has been bantered about, however, the term has not been defined properly for the Committee. Florida Greenways staff defined a greenway as being green and connecting or linking one place to another. They are often linear corridors such as shorelines and rivers. Greenways also have to be managed and afforded some level of protection. Trails are not greenways, but rather a way to experience the greenway. The greenway is protected corridor of land which the trail travels through.

The Steering Committee indicated that language used in the report needs to be as clear as possible. Vague language could cause problems in getting decision makers to buy into the plan. The Committee Members indicated that there was a great deal of effort put into the Wakulla County Comprehensive Plan and it should be used as the starting point for the report's conservation assessment and strategies. Macmillan stated that this report/plan is intended to be used as a guidance document offering recommendations to local and state planning agencies. Another concern raised by the Committee centered around what restrictions may be placed on river front land owners if the greenway is established. The report will attempt to address these concerns.

There was no input from the steering committee regarding the greenway's name. The remaining time was spent discussing the draft mission and vision statements. A few changes were recommended to the draft mission and vision statements including an emphasis on providing additional economic opportunities.
The meeting was adjourned at 12:20 p.m.

St. Marks River Greenways Steering Committee

A forum to discuss opportunities to conserve greenways on the St. Marks and Wakulla rivers

August, 26 1994

Agenda

10:00 a.m. Welcome

- Introductions, project status, and review of revised vision and mission statements, - Kent Wimmer, The Florida Greenways Program of 1000 Friends of Florida

- Presentation of Draft Land Use and Resource Feature Maps, Greenways Maps, and land ownership patterns maps - Tyler Macmillan, NWFWMD

11:00 a.m.

- Present Draft Greenways Assessment Report to the Steering Committee to discuss the committees' review process for the draft greenways assessment and discuss the next meeting on tentatively scheduled for September 9, 1994.

12:00 p.m.
Adjourn

Summary of the August 26 St. Marks Greenway Steering Committee Meeting

Wimmer opened the meeting to discuss the committee's charge and vision statements. No discussion resulted and the draft charge was adopted by the steering committee. Draft recommendations were presented during the meeting. The recommendations generated lively debate over the greenway concept. The recommendations as of this meeting were ideas and thoughts and were not refined in their wording. This vagueness caused confusion and apprehension among the steering committee members.

Some members of the steering committee indicated they did not want any more regulation and some of the preliminary recommendations are duplicated in other laws and regulations addressing wetlands and open space. Lead staff noted their concern and explained the greenway concept in more detail and asked for suggestions from the committee to resolve the vagueness in the language of the recommendations. Lead staff agreed to provide a draft of the recommendations to the committee for review. Members of the steering committee expressed concern over the greenway removing property from the tax roles. Lead staff explained the ecotourism and economic benefits of greenways for the region.

The meeting was adjourned at 12:15 p.m.